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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RPX CORPORATION and ADVANCED MICRO DEVICES, INC.,
Petitioner,

v.

IYM TECHNOLOGIES LLC,
Patent Owner.

Case IPR2017-01886
Patent 7,448,012 B1

Before MICHAEL R. ZECHER, MINN CHUNG, and
CARL L. SILVERMAN, *Administrative Patent Judges*.

ZECHER, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Petitioner, RPX Corporation and Advanced Micro Devices, Inc. (collectively, "RPX"), filed a Petition requesting an *inter partes* review of claims 1–14 of U.S. Patent No. 7,448,012 B1 (Ex. 1001, "the '012 patent"). Paper 1 ("Pet."). Patent Owner, IYM Technologies LLC ("IYM"), filed a Preliminary Response. Paper 8. Taking into account the arguments presented in IYM's Preliminary Response, we determined that the information presented in the Petition established that there was a reasonable likelihood that RPX would prevail in challenging at least one of claims 1–14 of the '012 patent as unpatentable under 35 U.S.C. § 103(a). Pursuant to 35 U.S.C. § 314, we instituted this *inter partes* review on March 8, 2018, as to all of the challenged claims and all grounds raised in the Petition. Paper 9 ("Dec. on Inst.").

During the course of trial, IYM filed a Patent Owner Response (Paper 14, "PO Resp."), RPX filed a Reply to the Patent Owner Response (Paper 20, "Pet. Reply"), and, with our authorization, IYM filed a Sur-Reply to the Reply (Paper 24, "PO Sur-Reply"). Each party was afforded the opportunity to file a one-page paper that identifies purported improper/proper arguments raised in the Sur-Reply. Papers 27, 30. A consolidated oral hearing with related Case IPR2017-01888 was held on December 11, 2018, and a transcript of the hearing is included in the record. Paper 34 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 1–14 of the '012 patent. For the reasons discussed below, we hold

that RPX has demonstrated by a preponderance of the evidence that these claims are unpatentable under § 103(a).

A. Related Matters

The parties indicate that the ’012 patent is involved in a district court case captioned *IYM Technologies LLC v. Advanced Micro Devices, Inc.*, No. 1:16-cv-00649-GMS (D. Del.). Pet. viii; Paper 4, 1. In addition to this Petition, RPX filed another petition challenging the patentability of claims 1–11, 13, and 14 of the ’012 patent (Case IPR2017-01888). Pet. viii; Paper 4, 1. A Final Written Decision for Case IPR2017-01888 is being entered concurrently.

B. The ’012 Patent

The ’012 patent, titled “Methods and System for Improving Integrated Circuit Layout,” issued November 4, 2008, from U.S. Patent Application No. 10/907,814, filed on April 15, 2005. Ex. 1001, [54], [45], [21], [22]. The ’012 patent claims priority to the following two provisional applications: (1) U.S. Provisional Application No. 60/603,758, filed on August 23, 2004; and (2) U.S. Provisional Application No. 60/564,082, filed on April 21, 2004. *Id.* at [60].

The ’012 patent generally relates to integrated circuit (“IC”) manufacturing and, in particular, to a method and system for generating and optimizing the layout artwork of an IC. Ex. 1001, 1:11–13. As background, the ’012 patent discloses that, in modern processing technology, the manufacturing yield of ICs (i.e., a measure of functioning devices in semiconductor testing) depends on their layout construction. *Id.* at 1:17–19. For a given manufacturing process, a set of design rules are applied during chip layout in order to avoid geometry patterns that cause chip failures. *Id.*

at 1:19–21. These design rules guarantee the yield by limiting layout geometry parameters, such as minimum spacing, minimal line width, etc. *Id.* at 1:21–23. Conventional layout construction systems cover the worst case scenario for all chips by applying these design rules over a wide chip area and to entire classes of circuits. *Id.* at 1:24–27.

The ’012 patent discloses that, in modern processing technology, many layout features may interact during chip processing. Ex. 1001, 1:29–31. These feature dependent interactions are difficult to capture with precise design rules and, as a result, sufficiently relaxed global design rules are implemented in order to guarantee the yield. *Id.* at 1:33–36. According to the ’012 patent, there are two drawbacks to this approach: (1) it clearly wastes chip area; and (2) determining the worst case scenario in all chips is a non-trivial task that consumes engineering resources. *Id.* at 1:37–40. The ’012 patent also discloses that some emerging processing technologies prefer one spatial direction over the other. *Id.* at 1:41–42. Existing layout generation systems, however, use identical minimal spacing and minimal width rules for both directions, which, according to the ’012 patent, leads to wasted chip area and underutilization of processing capabilities because the design rules must cover the worst case scenario in both directions. *Id.* at 1:42–46.

The ’012 patent purportedly addresses these and other problems by providing a method and system for forming layout constraints to account for local and orientation processing dependencies. Ex. 1001, 1:51–54. By combining a local process modification value, which represents an additional safeguard beyond an original design rule constraint, with the original design rule constraint itself, it effectively creates a new constraint

for every unique local situation. *Id.* at 1:55–64, 4:3–5. This mechanism adds extra safeguards to design rule formulation and improves chip yield by eliminating processing hotspots. *Id.* at 1:64–67, 4:5–6.

C. Illustrative Claim

Claim 1 is the only independent claim at issue. Independent claim 1 is directed to "[a] method for generating design layout artwork implemented in a computer." Ex. 1001, 8:16–17. Claims 2–14 directly depend from independent claim 1. Independent claim 1 is illustrative of the challenged claims and is reproduced below:

> 1. A method for generating design layout artwork implemented in a computer, comprising:
>
> receiving a design layout comprising a plurality of layout objects residing on a plurality of layers;
>
> receiving descriptions of manufacturing process;
>
> constructing a system of initial constraints among said layout objects;
>
> computing local process modifications to change said initial constraints using said descriptions of manufacturing process;
>
> constructing new local constraint distances by combining said local process modifications with constraint distances in said system of initial constraints;
>
> enforcing said new local constraint distances; and
>
> updating the coordinate variables of layout objects according to the solutions obtained from enforcing said new local constraint distances;
>
> whereby a new layout is produced that has increased yield and performance.

Ex. 1001, 8:15–35.

D. Prior Art Relied Upon

RPX relies upon the prior art references set forth in the table below:

Inventor[1]	**U.S. Patent No.**	**Relevant Dates**	**Exhibit No.**
Côté	6,745,372 B2	issued June 1, 2004, filed Apr. 5, 2002	1004
Bamji	5,663,891	issued Sept. 2, 1997, filed Apr. 3, 1996	1005
Kroyan	7,523,429 B2	issued Apr. 21, 2009, filed Feb. 18, 2005	1006
Cobb	6,249,904 B1	issued June 19, 2001, filed Apr. 30, 1999	1007

E. Instituted Grounds of Unpatentability

We instituted a trial based on the asserted grounds of unpatentability ("grounds") set forth in the table below. Dec. on Inst. 31.

Reference(s)	**Basis**	**Challenged Claim(s)**
Côté	§ 103(a)	1–3, 5, 13, and 14
Côté and Bamji	§ 103(a)	1–3, 5, 10, 11, and 13
Côté, Bamji, and Kroyan	§ 103(a)	3, 4, and 6–9
Côté, Bamji, and Cobb	§ 103(a)	12

II. ANALYSIS

A. Claim Construction

In an *inter partes* review proceeding filed before November 13, 2018, claim terms of an unexpired patent are given their broadest reasonable interpretation in light of the specification of the patent in which they appear.

[1] For clarity and ease of reference, we only list the first named inventor.

37 C.F.R. § 42.100(b) (2018).[2] Under the broadest reasonable interpretation standard, claim terms are generally given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art, in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

In the Decision on Institution, because there was no dispute between the parties regarding claim construction at the preliminary stage, we did not construe explicitly any claim term of the '012 patent. Dec. on Inst. 6–7 (citing *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)))). After reviewing the record developed during trial, we maintain that no claim term of the '012 patent requires an explicit construction for purposes of this Final Written Decision.

In its Patent Owner Response, IYM proposes constructions for the following claim terms: (1) "constraints"; (2) "enforcing said new local constraint distances"; (3) "description(s) of manufacturing process"; and (4) "width," "space," "overlap," "enclosure," and "extension." PO Resp. 14–22. Beginning with IYM's proposed constructions for the claim terms "constraints," "description(s) of manufacturing process", and "width," "space," "overlap," "enclosure," and "extension," there is no dispute

[2] A different rule applies for petitions filed on or after November 13, 2018. Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b)).

between the parties regarding the proper constructions for these claim terms. *Compare* PO Resp. 14–17, 22, *with* Pet. 17–19, 28–29.

Turning to IYM's proposed construction for the claim term "enforcing said new local constraint distances," IYM contends that this claim term should be construed as "finding solutions (i.e., adjustments to the layout) that remove violations of the new local constraint distances." PO Resp. 17. IYM, however, asserts that it only offers an explicit construction to "crystallize the issues with respect to the Allan reference in [Case] IPR2017-01888." *Id.* at 21. Indeed, IYM does not argue separately whether RPX properly relies on Côté, which serves as the primary reference in the grounds based on obviousness raised in this proceeding, to teach or suggest the claim term "enforcing said new local constraint distances." *See generally id.* at 30–57, 62–65 (limiting its arguments to whether Côté teaches or suggests the "local process modifications" and "new local constraint distances," as recited in independent claim 1); *see also* Pet. Reply 5 ("IYM does not challenge that Côté meets the 'enforcing' limitation, and disputes only whether 'the Allan reference in [Case] IPR2017-01888' does. [PO Resp.] 17, 21; . . . Ex. 1027, 252:15–253:9 (confirming that construction of 'enforcing' limitation is not relevant to opinions regarding Côté)."). Because IYM does not challenge RPX's arguments and evidence as to whether Côté teaches or suggests the claim term "enforcing said new local constraint distances," we need not construe explicitly this claim term for purposes of this Final Written Decision. *See Nidec Motor Corp.*, 868 F.3d at 1017.

B. Obviousness Over the Teachings of Côté

RPX contends that claims 1–3, 5, 13, and 14 of the '012 patent are unpatentable under § 103(a) over the teachings of Côté. Pet. 21–40. RPX explains how Côté teaches or suggests the subject matter of each challenged claim, and provides reasoning as to the reasonable inferences one of ordinary skill in the art would be expected to draw from the teachings of that reference. *Id.* RPX also relies on the Declaration of Dr. Nagel to support its positions. Ex. 1002 ¶¶ 138–187, 252–263. In its Patent Owner Response, IYM presents a number of arguments, most of which focus on whether Côté teaches or suggests "computing local process modifications to change said initial constraints using said descriptions of manufacturing process" and "constructing new local constraint distances by combining said local process modifications with constraint distances in said system of initial constraints," as recited in independent claim 1. PO Resp. 30–57. IYM relies upon the Declaration of Dr. Bernstein to support its positions. Ex. 2012 ¶¶ 73–112.

We begin our analysis with the principles of law that generally apply to a ground based on obviousness, followed by an assessment of the level of skill in the art, proceeded by a brief overview of Côté, and then we address the parties' contentions with respect to the claims at issue in this asserted ground.

1. Principles of Law

A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of

obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze this asserted ground based on obviousness with the principles identified above in mind.

2. Level of Skill in the Art

There is evidence in the record before us that enables us to determine the knowledge level of a person of ordinary skill in the art. Relying on the testimony of its declarant, Dr. Nagel, RPX asserts that a person of ordinary skill in the art as of April 2004, which is the earliest priority date on the face of the '012 patent, would be an individual who possesses "a bachelor's degree in Electrical Engineering or the equivalent, along with at least two years of experience in developing and/or researching integrated circuit technology." Pet. 16 (citing Ex. 1002 ¶¶ 30–32). IYM's declarant, Dr. Bernstein, generally agrees with the assessment of RPX and Dr. Nagel, but further clarifies that "a person of ordinary skill in the art would have had a sufficient familiarity with [electronic design automation] tools to be able to competently use such tools and understand their operation." PO Resp. 12–13 (citing Ex. 1002 ¶ 31; Ex. 2012 ¶¶ 26–29).

We do not discern a material difference between the assessments advanced by the declarants, nor does either party premise its arguments exclusively on its assessment of the level of skill in the art. Moreover, each party's declarant appears to meet or exceed both parties' assessments (*see* Ex. 1002 ¶¶ 2–13; Ex. 1003; Ex. 2012 ¶¶ 3–19, Curriculum Vitae), and

either assessment of the level of skill in the art is consistent with the '012 patent and the asserted prior art. We, therefore, adopt Dr. Nagel's assessment and apply it to our obviousness evaluation below, but note that our conclusions would remain the same under Dr. Bernstein's assessment.

3. Côté Overview

Côté generally relates to the process of designing an IC and, in particular, to simulating effects of a manufacturing process on an IC to enhance process latitude and/or reduce layout size. Ex. 1004, 1:9–13. Figure 5 of Côté, reproduced below, illustrates generating and enhancing the layout of an IC in accordance with one embodiment. *Id.* at 3:53–55, 5:8–10.

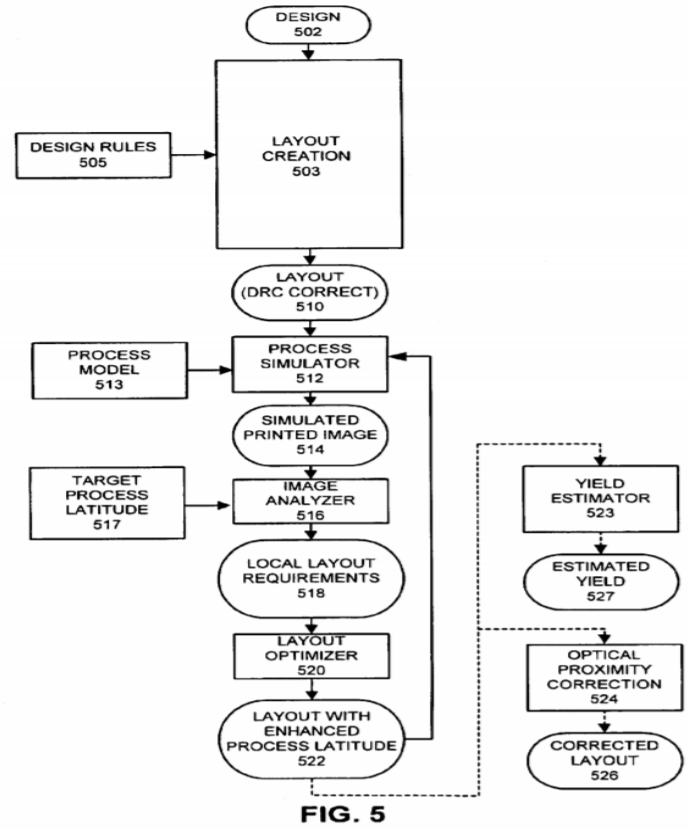


FIG. 5

Figure 5, reproduced above, depicts layout creation process 503 that receives design 502 and "ensures that the resulting layout 510 satisfies a set of design

rules 505." Ex. 1004, 5:12–14. Next, layout 510 is "[fed] through process simulator 512," which, in turn, "uses a process model 513 to generate a simulated printed image 514 for the layout." *Id.* at 5:17–19. Simulated printed image 514 "may include a number of printed images generated using different process parameters." *Id.* at 5:19–22. This allows process simulator 512 to determine how the changes in process parameters will affect the printed image. *Id.* at 5:22–24.

Côté further discloses that "image analyzer 516 uses the simulated printed image 514 to generate local layout requirements 518 to optimize the process latitude and/or layout characteristics" (e.g., area). Ex. 1004, 5:29–32. These "additional constraints 518" are "[fed] into a layout optimizer 520, which further optimizes the layout." *Id.* at 5:32–35. In at least one instance, "layout optimizer 520 attempts to update the layout to produce a layout 522 with enhanced process latitude." *Id.* at 5:36–38. "[L]ayout 522 can additionally feed into yield estimator 523 to produce an estimated yield 527 for the [IC]." *Id.* at 5:55–57. According to Côté, "[this] simulation process can be applied to the enhanced layout in an iterative fashion to further improve process latitude for the layout." *Id.* at 5:58–60.

4. Claim 1

In its Petition, RPX primarily relies on the generation and enhancement of a layout as illustrated in Figure 5 of Côté and its corresponding description to teach all of the limitations of independent claim 1. Pet. 24–38. Beginning with the recitation in the preamble of "[a] method for generating design layout artwork implemented in a computer," RPX argues that Côté teaches this intended use language because it discloses techniques implemented by various software components, including an

image analyzer 516 that generates local layout requirements 518 and layout optimizer 520 that optimizes the layout and generates enhanced layout 522. *Id.* at 24 (citing Ex. 1004, 2:48, 6:60–63; Ex. 1002 ¶ 137).

The first method step of independent claim 1 is "receiving a design layout comprising a plurality of layout objects residing on a plurality of layers." Ex. 1001, 8:18–19. RPX argues that Côté teaches this "receiving" method step because the embodiment illustrated in Figure 5 indicates that layout creating process 503 receives design 502. Pet. 24 (citing Ex. 1004, 2:38–44, 4:51–52, 5:13–17, Figs. 1, 6, 7; Ex. 1002 ¶ 139). Relying on the testimony of Dr. Nagel, RPX argues that one of ordinary skill in the art would have understood that Côté's layout (such as layout 510 disclosed in the context of Figure 5) includes a plurality of layout objects, which, in turn, reside on a plurality of layers. *Id.* at 25 (citing Ex. 1002 ¶ 140). RPX also directs us to Figure 7 of Côté as one example of a simulated printout image produced from a layout that includes a plurality of objects and multiple layers. *Id.* at 25–26 (citing Ex. 1004, 5:18–30, 6:31, Fig. 7; Ex. 1002 ¶¶ 141–149).

The second method step of independent claim 1 is "receiving descriptions of manufacturing process." Ex. 1001, 8:20. RPX argues that Côté teaches this "receiving" method step because layout creation process 503 illustrated in Figure 5 receives design rules 505 that "specify a number of constraints, such as minimum spacings or minimum line widths, to increase the likelihood that the finished [IC] functions properly in spite of different manufacturing effects." Pet. 27 (quoting Ex. 1004, 1:58–63) (citing Ex. 1004, 5:12–14, Fig. 5). RPX also argues that Côté teaches this "receiving" method step because simulator 512 uses process model 513 to

generate simulated printed image 514 for the layout. *Id.* According to RPX, Côté's simulated printed image 514 may include a number of printed images generated using different process parameters so as to "determine how the printed image will be affected by changes in process parameters." *Id.* (quoting Ex. 1004, 5:18–24). Relying on the testimony of Dr. Nagel, RPX asserts that one of ordinary skill in the art would have understood that both Côté's design rules and simulation models serve as examples of information describing a manufacturing process. *Id.* at 26–27 (citing Ex. 1002 ¶¶ 150–154).

The third method step of independent claim 1 is "constructing a system of initial constraints among said layout objects." Ex. 1001, 8:21–22. RPX argues that IYM should be held to its proposed construction of the claim term "constraints" in the related district court case as "limits on geometry parameters of the layout objects in the design layout." Pet. 28 (citing Ex. 1017, 4–6). As support for this construction, RPX directs us to various disclosures in the specification of the '012 patent. *Id.* (citing Ex. 1001, 3:10–11, 3:16–17, 3:28–29). Applying the aforementioned construction of the claim term "constraints," RPX argues that Côté similarly discloses determining constraints for layout 510 using design rules 505. *Id.* at 29 (citing Ex. 1004, 1:59–60, 4:46–54, 5:12–14). Relying on the testimony of Dr. Nagel, RPX argues that one of ordinary skill in the art would have appreciated that Côté's process of applying design rules 505 to layout 510 is identical to the parlance of the '012 patent of "constructing a system of initial constraints among said layout objects." *Id.* (citing Ex. 1002 ¶ 158).

The fourth method step of independent claim 1 is "computing local process modifications to change said initial constraints using said descriptions of manufacturing process." Ex. 1001, 8:23–25. RPX argues that Côté teaches this "computing" method step because it discloses simulating the effects of manufacturing processes on layout 510 in order to identify problem areas from which local layout requirements may be derived. Pet. 31 (citing Ex. 1004, 2:37–46, 5:17–29; Ex. 1002 ¶¶ 162–167). According to RPX, after identifying problem areas in layout 510, Côté uses those problem areas to generate local layout requirements 518 to optimize latitude and/or layout characteristics (e.g., area). *Id.* (citing Ex. 1004, 2:8–10, 2:45–47, 5:31–36, 6:31–40). RPX asserts that Côté discloses generating layout requirements 518 from running simulations (i.e., "descriptions of manufacturing process"), and using those local layout requirements 518 to change the "initial constraints," which constitutes the claimed "local process modifications." *Id.* at 32 (citing Ex. 1004, 3:10–12, 5:18–31).

The fifth method step of independent claim 1 is "constructing new local constraint distances by combining said local process modifications with constraint distances in said system of initial constraints." Ex. 1001, 8:26–28. RPX argues that Côté teaches this "constructing" method step because it discloses feeding additional constraints 518 generated from local process modifications into layout optimizer 520, "which further optimizes the layout." Pet. 33 (quoting Ex. 1004, 5:31–36). According to RPX, Côté's newly constructed constraint distances (i.e., additional constraints 518) are applied to local areas of the layout during the optimization process and, therefore, constitute the claimed "new local constraint distances." *Id.* (citing Ex. 1004, 2:10–12, 5:9–33, 6:9–17, 6:31–40). Relying on the

testimony of Dr. Nagel, RPX asserts that Côté discloses generating the newly constructed constraint distances based on both the original design rules, as well as the local process modifications determined from running simulations. *Id.* at 33–34 (citing Ex. 1002 ¶¶ 168–171).

The sixth method step of independent claim 1 is "enforcing said new local constraint distances." Ex. 1001, 8:29. RPX argues that the '012 patent discloses enforcing constraints by executing an optimization process incorporating those constraints. Pet. 35 (citing Ex. 1001, 3:65–67, 4:17–67). RPX argues that Côté teaches this "enforcing" method step because, similar to the optimization approach disclosed in the '012 patent, Côté discloses feeding additional constraints 518 into layout optimizer 520 to produce enhanced layout 522 with improved process latitude. *Id.* (citing Ex. 1004, 5:32–33). According to RPX, Côté's production of enhanced layout 522 confirms that additional constraints 518 are enforced. *Id.* at 35–36 (citing Ex. 1004, 6:52–59; Ex. 1002 ¶¶ 176–178).

The seventh method step of independent claim 1 is "updating the coordinate variables of layout objects according to the solutions obtained from enforcing said new local constraint distances." Ex. 1001, 8:30–32. RPX argues that Côté teaches this "updating" method step because layout optimizer 520 produces enhanced layout 522, which also may be used to improve process yield by feeding it into yield estimator 523 to produce estimated yield 527. Pet. 36 (citing Ex. 1004, 2:48–64, 5:8–50). RPX also directs us to Figure 6 of Côté as one example of updating the coordinates of layout shapes based on an enhanced layout. *Id.* (citing Ex. 1004, 6:7–12, Fig. 6). RPX asserts that Côté's optimization results are the claimed "solutions obtained from enforcing said new local constraint distances," and

that Côté's movement of the objects in the enhanced layout amounts to the claimed "updating the coordinate variables of layout objects" according to the solutions produced by layout optimizer 520 in enforcing local layout requirements 518. *Id.*

The last limitation of independent claim 1 is "whereby a new layout is produced that has increased yield and performance." Ex. 1001, 8:33–34. RPX argues that IYM should be held to its position in the related district court case that the "whereby" clause is not limiting. Pet. 37 (citing Ex. 1017, 15). RPX further argues that, to the extent we determine that the "whereby" clause is limiting, Côté discloses this limitation because it uses layout optimizer 520 to enhance layout 510 in order to improve process latitude. *Id.* (citing Ex. 1004, 5:8–35). Relying on the testimony of Dr. Nagel, RPX asserts that a person of ordinary skill in the art would have understood that (1) an improvement to process latitude would improve yield; and (2) compaction could increase the performance of an IC (e.g., by reducing worst case path delay). *Id.* at 37–38 (citing Ex. 1002 ¶ 185). RPX asserts, therefore, that Côté's IC resulting from the new enhanced layout would have increased yield and performance. *Id.*

In its Patent Owner Response, IYM's arguments can be grouped as follows: (1) RPX blurs the line between anticipation and obviousness; (2) Côté does not teach or suggest "computing local process modifications to change said initial constraints using said descriptions of manufacturing process"; (3) Côté does not teach or suggest "constructing new local constraint distances by combining said local process modifications with constraint distances in said system of initial constraints"; and (4) the

remaining arguments. We address these groupings of arguments in turn. *See* PO Resp. 30–57.

a. The Relevant Inquiry Is One of Obviousness—Not Anticipation

As an initial matter, we address IYM's vague assertions implying RPX's asserted ground based on Côté alone is actually one of anticipation—not obviousness. As one example, when addressing whether RPX may rely on the teachings of Côté together with Dr. Nagel's supporting testimony, IYM asserts that "'[a]n expert's conclusory testimony, unsupported by the documentary evidence, cannot supplant the requirement of anticipatory disclosure in the prior art reference itself.'" PO Resp. 2 (quoting *Motorola, Inc. v. Interdigital Tech. Corp.*, 121 F.3d 1461, 1473 (Fed. Cir. 1997)); *see also id.* at 43 (arguing the same). As another example, when arguing that a person of ordinary skill in the art cannot provide the limitations purportedly missing from Côté, IYM states that "Côté does not anticipate the challenged claims." *Id.* at 54. Yet another example is IYM's argument that "[RPX] appear[s] to 'confuse[] anticipation . . . with obviousness, which, though anticipation is the epitome of obviousness, are separate and distinct concepts.'" *Id.* at 55 (quoting *Jones v. Hardy*, 727 F.2d 1524, 1529 (Fed. Cir. 1984)).

Similar to the arguments presented at the preliminary stage, we understand IYM to assert that the ground based on Côté alone blurs the line between anticipation and obviousness. Contrary to IYM's assertion, RPX does not argue that Côté anticipates the challenged claims, but rather it argues that the teachings of Côté together with the background knowledge of one of ordinary skill in the art renders the challenged claims obvious. Pet. 21–40; *see also* PO Resp. 54 (admitting that, "in fact [RPX] do[es] not

even argue anticipation by Côté"). As support for this and other obviousness grounds raised in the Petition, RPX explains:

> The claims call out specific features that do not contribute to the purported inventiveness of the '012 patent and are instead the type of information that publications in this field typically assume is within the reader's knowledge and do not explicitly discuss. For this reason, . . . obviousness grounds are presented rather than anticipation, even where a single reference is cited. Dr. Nagel's testimony is cited for these well-known features, together with supporting evidence.

Pet. 8. Under the circumstances described by RPX, it is appropriate to apply a single prior art reference—in this case, Côté—together with the background knowledge of one of ordinary skill in the art—as evidenced by Dr. Nagel's supporting testimony—in analyzing obviousness. *See Monsanto Tech. LLC v. E.I. DuPont de Nemours & Co.*, 878 F.3d 1336, 1346–47 (Fed. Cir. 2018) ("Though less common, in appropriate circumstances, a patent can be obvious in light of a single prior art reference if it would have been obvious to modify the reference to arrive at the [claimed] invention.") (quoting *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016)); *see also Realtime Data LLC v. Iancu*, 912 F.3d 1368, 1373 (Fed. Cir. 2019) (affirming the Board's conclusion that claims were obvious based on one prior art reference alone notwithstanding patent owner's argument that the ground at issue would have been more properly raised under 35 U.S.C. § 102).

b. Côté Teaches "Local Process Modifications"

In its Patent Owner Response, IYM contends that it is unclear what teachings in Côté satisfy the claimed "local process modifications" and "new local constraint distances." PO Resp. 32. IYM argues that the diversity of

opinions between RPX's and Dr. Nagel's strained reading of Côté and the Board's preliminary findings indicate that Côté is susceptible to fundamentally different readings, none of which renders obvious the challenged claims. *Id.* at 32–33 (citing Pet. 34–35; Ex. 2013, 183:20–184:14, 185:14–21, 186:10–24, 236:23–237:6; Dec. on Inst. 19; Ex. 2012 ¶ 76). IYM further argues that Côté's local layout requirements and additional constraints, each of which are identified using numeral 518, are one and the same. *Id.* at 33–34 (citing Ex. 1004, 5:30–34, Fig. 5; Ex. 1002 ¶ 78; Ex. 2013, 207:4–5; Ex. 2012 ¶ 77). IYM asserts that it would be improper for RPX to rely on the same element in Côté (i.e., local layout requirements 518 and additional constraints 518) to teach two separately identifiable features of the claimed invention—namely, the claimed "local process modifications" and "new local constraint distances." *Id.* at 34–35 (citing Ex. 2012 ¶ 78).

IYM further contends that RPX also relies on Côté's identification of problem areas in an attempt to compensate for Côté's purported failure to explain local layout requirements 518, how they are computed, or how they are used. PO Resp. 43 (citing Pet. 31). According to IYM, identifying problem areas does not play any role in the determination of Côté's local layout requirements 518 because only layout optimizer 520—not image analyzer 516—identifies problem areas. *Id.* at 43–44 (citing Ex. 1004, 5:30–31, Fig. 5; Ex. 2012 ¶¶ 89, 90). To support this argument, IYM directs us to Dr. Nagel's cross-examination testimony in which he purportedly confirms that Côté generates local layout requirements 518 prior to running layout optimizer 520. *Id.* at 44–45 (citing Ex. 2013, 239:17–240:2; Ex. 1004, 5:33–36; Ex. 2012 ¶ 91).

In its Reply, RPX counters that Côté's local layout requirements 518 are used to change the initial constraints imposed by design rules 505, and that change, which is calculated from the simulations received from process simulator 512, teaches the claimed "local process modifications." Pet. Reply 7 (citing Ex. 1004, 2:8–12, 2:45–47, 5:31–36, 6:9–17; Ex. 1002 ¶¶ 162–167), 8 (arguing that "the change (calculated from the simulation) is a 'local process modification' in the language of [independent] claim 1" (emphasis omitted)). RPX argues that IYM does not address Dr. Nagel's unrefuted testimony other than to argue that Côté's optimization process does not involve identifying problem areas. *Id.* at 7. RPX further argues that, when reading Côté, as a whole, Côté identifies problem areas before running layout optimizer 520 so that it can produce a new target layout addressing those problem areas. *Id.* at 15–16 (citing Pet. 22–23, 31–33; Ex. 1005, 2:38–50, 5:29–36).

In its Sur-Reply, IYM reiterates its argument that "local process modifications" and "new local constraint distances" are separately identifiable features of the claimed invention, and RPX cannot rely on Côté's local layout requirements and additional constraints, each of which is identified using numeral 518, to teach both of these claimed features. PO Sur-Reply 1–2 (citing Pet. Reply 23–24). IYM then argues that RPX's Reply mischaracterizes its position regarding these claimed features and then changes theories by arguing that Côté's changes to the local layout requirements 518 constitute the claimed "local process modifications." *Id.* at 2–3 (citing Pet. 33, 50, 51; Pet. Reply 3, 23–24). IYM argues that RPX's purported new theory fails for the following three reasons: (1) at best, Côté discloses changes to the shapes of a design layout—not changes to

constraints of the design layout; (2) Dr. Nagel's cross-examination testimony contradicts RPX's position that Côté's changes to the local layout requirements 518 constitute the claimed "local process modifications"; and (3) RPX's Reply is replete with confusing and contradictory statements regarding "local layout requirements," "additional constraints," "changes," and "distance." *Id.* at 3–5.

Based on the record developed during trial, we agree with RPX and its declarant, Dr. Nagel, that the changes to initial design rules 505 that result from running simulations on layout 510 amount to the claimed "local process modifications." Côté's process of generating and enhancing a design layout begins with inputting design 502 and ensuring that resulting layout 510 satisfies a set of initial design rules 505. Ex. 1004, 5:12–14. After running simulations on layout 510 using process simulator 512, image analyzer 516 analyzes simulated printed image 514 to identify problem areas, and then uses those problem areas to generate local layout requirements 518 to optimize latitude and/or layout characteristics (e.g., area). *Id.* at 5:30–33; *see also id.* at [57] ("The system . . . identifies problem areas in the simulated printed image that do not meet a specification."), Fig. 7 (illustrating problem areas in a printed image using highlighted white boxes). One example of a problem area is that the edges of the features may be spaced too closely together to cause potential bridging. *Id.* at 6:31–40, Fig. 7. This problem is addressed by creating a larger space between the features. *Id.* at 6:9–17, 6:31–40, Figs. 6, 7.

Based on these and other disclosures in Côté, RPX's declarant, Dr. Nagel, testifies that "Côté discloses simulating effects of manufacturing processes on . . . layout [510] to identify problem areas, from which local layout requirements are derived." Ex. 1002 ¶ 163 (citing Ex. 1004, 2:37–46, 5:17–29). Dr. Nagel further testifies that "Côté's 'local layout requirements [518]' are used to 'change' the initial constraint [imposed by design rules 505], and the change that is (calculated using the simulations) is a 'local process modification,'" as claimed. *Id.* ¶ 166. We credit Dr. Nagel's testimony in this regard because it is consistent with Côté's disclosure of the changes to initial design rules 505 that result from running simulations on layout 510.

Although IYM is correct that Côté identifies both local layout requirements and additional constraints using numeral 518 (Ex. 1001, 5:30–34), we do not agree with its argument that RPX relies on the same element in Côté to teach both the claimed "local process modifications" and "new local constraint distances." *See* PO Resp. 33–35; PO Sur-Reply 1–2. RPX relies on different teachings of Côté—albeit interrelated teachings—to account for these two claimed features. As we explain above, RPX relies on the changes to initial design rules 505 that result from running simulations on layout 510 to teach the claimed "local process modifications." As we explain below, RPX relies on Côté's additional constraints 518, which is the product of combining the changes identified above with the initial design rules 505, to teach the claimed "new local constraint distances." *See infra* Section II.B.4.c.

During cross-examination, Dr. Nagel was asked whether Côté's local layout requirements and additional constraints, each of which is identified

using numeral 518, are the same thing. The relevant exchange is reproduced below.

> Q. Just to be clear, additional constraints 518 and local layout requirements 518 are the same thing; correct?
>
> A. Well, I guess it depends upon who you talk to. . . . I think the correct way of interpreting this is that the local layout requirements, which are the [local design rules], and the [global design rules] together form the new constraints 518 which feed into the layout optimizer [520]. So they've called—they're referring to the same thing by two different names, but elsewhere I think they mean different things by "layout requirements" than they do "additional constraints."
>
> Q. So you think the disclosure of Côté would be unclear to a person of ordinary skill?
>
> . . .
>
> [A.] I think it might cause a little confusion. I think once you sit down and study [Côté], you can figure out what they mean. But it's an unfortunate choice of words.

Ex. 2013, 183:20–184:14. We understand Dr. Nagel to testify that Côté's identification of both local layout requirements and additional constraints using numeral 518 was "an unfortunate choice of words," but nonetheless, when reading Côté, as a whole, one of ordinary skill in the art would have appreciated the subtle differences. This is consistent with general principles of obviousness, specifically that Figure 5 of Côté and its corresponding description of local layout requirements and additional constraints 518 "must be read, not in isolation, but for what it fairly teaches in combination with the prior art as a whole." *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *see also In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986) (explaining that, when evaluating claims for obviousness, "the prior art as a whole must be considered").

We also do not agree with IYM's argument that Côté's identification of problem areas cannot be used to compute the claimed "local process modifications." *See* PO Resp. 43–45. IYM's argument in this regard is predicated on the notion that problem areas are not used to generate local layout requirements 518 because, when describing the generation and enhancement of a layout as illustrated in Figure 5 of Côté, the description of layout optimizer 520 is preceded by the following statement: "[n]ote that this further optimization can involve identifying problem areas in the layout as is illustrated in [Figure] 7." Ex. 1004, 5:30–36. When reading Côté, as a whole, it becomes clear that image analyzer 516 identifies problem areas and then uses those problem areas to generate local layout requirements 518, all of which occurs prior to layout optimizer 520 producing enhanced layout 522.

Côté's Abstract, which is produced below, provides context regarding the temporal significance of the processing steps illustrated in Figure 5 of Côté.

> During operation, the system receives a representation of a target layout for the integrated circuit . . . . *Next*, the system simulates effects of the manufacturing process on the target layout to produce a simulated printed image for the target layout. The system *then* identifies problem areas in the simulated printed image that do not meet a specification. *Next*, the system moves corresponding shapes in the target layout to produce a new target layout for the [IC].

Ex. 1004, [57] (emphases added), 2:41–50 (disclosing the same). Côté further discloses that "moving the corresponding shapes in the target layout involves applying relaxed rules to the problem areas of the target layout to improve process latitude." *Id.* at 3:1–4, 3:7–9 (disclosing the same).

Applying this temporal significance to Côté's Figure 5, it follows that "problem areas" in layout 510 are identified and addressed (i.e., by image analyzer 516 using simulated image 514 to identify problem areas, and then using those problem areas to generate local layout requirements 518) prior to feeding additional constraints 518 into layout optimizer 520 to produce enhanced layout 522.

The cross-examination testimony of Dr. Nagel also supports our determination in this regard. When asked whether "local layout requirements [518] must be calculated prior to running . . . layout optimizer [520]," Dr. Nagel responded "Yes. They're calculated by . . . image analyzer [516]." Ex. 2013, 239:20–24. Dr. Nagel was then asked "[s]o . . . layout optimizer [520] does not calculate local layout requirements [518]; correct?" Dr. Nagel unequivocally responded "No." *Id.* at 239:25–240:2. We credit this testimony from Dr. Nagel because it is consistent with the temporal significance attributed to the processing steps illustrated in Figure 5 of Côté.

Lastly, we do not agree with IYM's argument that RPX's Reply presents a new theory as to how the teachings of Côté account for the claimed "local process modifications." *See* PO Sur-Reply 2–5. Contrary to IYM's arguments, RPX consistently and repeatedly takes the position that Côté's changes to initial design rules 505 that result from running simulations on layout 510 teach the claimed "local process modifications." *Compare* Pet. 31–32, *with* Pet. Reply 7–8. As we explain above, this position has a sufficient basis in the teachings of Côté and it is supported by Dr. Nagel's testimony. Ex. 1004, 5:9–62, 6:9–17, 6:31–40, Figs. 5, 7; Ex. 1002 ¶¶ 162–167; Ex. 2013, 183:20–184:14, 239:17–240:2.

c. Côté Teaches "New Local Constraint Distances"

In its Patent Owner Response, IYM contends that Côté's additional constraints 518 do not constitute the claimed "new local constraint distances." PO Resp. 37. According to IYM, there are a number of reasons as to why the layout optimization illustrated in Figure 6 of Côté does not require "new local constraint distances." *Id.* As one example, IYM argues that the corresponding description of Figure 6 does not mention constraint distances at all. *Id.* at 38 (citing Ex. 1004, 5:65–6:28). As another example, IYM argues that, at his deposition, Dr. Nagel purportedly agreed that the layout optimization illustrated in Figure 6 could be obtained from the application of two additional constraints that are not constraint distances. *Id.* at 38. Relying on an annotated version of Figure 6 that is Exhibit 2018, IYM asserts that the two constraint distances are not "new local constraint distances," but rather they are two fixed positions. *Id.* at 38–39 (citing Ex. 1004, Fig. 6; Ex. 2012 ¶¶ 82, 83; Ex. 2013, 200:20–201:8, 210:22–211:10). IYM also argues that Exhibit 2019 represents Dr. Nagel's own depiction of Figure 6, but the hypothetical additional constraint d_1 he inserted into this figure is not supported by the teachings of Côté. *Id.* at 39–40 (citing Ex. 2012 ¶ 84; Ex. 2013, 254:12–255:6; Ex. 2019).

Next, IYM contends that Côté's additional constraints 518 are not obtained "by combining . . . local process modifications with constraint distances in [a] system of initial constraints," as recited in independent claim 1. PO Resp. 40 (citing Ex. 1004, 5:30–34). According to IYM, Dr. Nagel purportedly agreed that Côté does not explain how to compute additional constraints 518. *Id.* at 40–41 (citing Ex. 2012 ¶ 85; Ex. 2013, 191:13–19). Relying once again on an annotated version of Figure 6 that is

Exhibit 2018, IYM asserts that the two additional constraints illustrated in this figure are not constructed from constraint distances, let alone "by combining . . . local process modifications with constraint distances in [a] system of initial constraints." *Id.* at 41 (citing Ex. 2012 ¶ 86; Ex. 2013, 211:18–24).

IYM further contends that Dr. Nagel's reading of independent claim 1 contradicts his testimony that Côté's additional constraints 518 constitute the claimed "new local constraint distances." PO Resp. 41–42. According to IYM, Dr. Nagel testified, at his deposition, that "combining said local process modifications with constraint distances in said system of initial constraints," as recited in independent claim 1, cannot be satisfied by adding an entirely new constraint to the system of initial constraints. *Id.* at 42 (citing Ex. 2013, 65:15–19). IYM asserts that RPX's reading of Côté is exactly what Dr. Nagel believes is not covered by the aforementioned "combining" limitation—namely, feeding additional constraints 518 into layout optimizer 520, in addition to the initial constraints derived from design rules 505. *Id.* (citing Pet. 29, 30, 34; Ex. 1002 ¶¶ 158, 159, 172; Ex. 2012 ¶ 87).

Lastly, IYM contends that RPX improperly relies on Dr. Nagel's testimony to recreate the challenged claims from Côté's inadequate disclosure. PO Resp. 42. According to IYM, Côté's disclosure is missing the entire method step of "constructing new local constraint distances by combining said local process modifications with constraint distances in said system of initial constraints," as recited in independent claim 1. *Id.* at 42–43 (citing Ex. 2012 ¶ 88). IYM asserts that, contrary to precedent from the U.S. Court of Appeals for the Federal Circuit, RPX relies on Dr. Nagel's

conclusory testimony, unsupported by documentary evidence, to fill the gaps in the teachings of Côté. *See id.* at 43 (first citing *Motorola*, 121 F.3d at 1473; and then citing *Zoltek Corp. v. United States*, 815 F.3d 1302, 1309–14 (Fed. Cir. 2016)).

In its Reply, RPX counters that Côté's additional constraints 518, which are constructed from the initial distances imposed by initial design rules 505 in a local area, as well as the local process modifications determined from running simulations on layout 510, teach the claimed "new local constraint distances." Pet. Reply 8 (citing Pet. 33–35; Ex. 1004, 2:10–12, 5:31–36, 6:9–17). RPX disagrees with IYM's primary argument that Côté's additional constraints 518 do not constitute the claimed "new local constraint distances" because they are not constructed in the manner required by independent claim 1. *Id.* at 11. RPX asserts that this argument ignores Côté's actual teachings and mischaracterizes Dr. Nagel's cross-examination testimony. *Id.*

RPX also disagrees with IYM's argument that Côté never explains how to compute additional constraints 518, nor does it explain how to compute their numerical values. Pet. Reply 11. RPX contends that a particular algorithm for computing numerical values is irrelevant because no specific algorithm is claimed. *Id.* RPX also argues that IYM fails to consider Côté, as a whole. *Id.* at 12. RPX further contends that, IYM's declarant, Dr. Bernstein conceded that a person of ordinary skill in the art would have known that "constraints" are "limits on geometry parameters of the layout object in the design layout." *Id.* (citing Ex. 2012 ¶ 49; Ex. 1027, 52:2–12). RPX then argues that Côté's constraints are consistent with this construction because they can impose minimum distances. *Id.* (citing

Ex. 1004, 1:59–60). RPX asserts that, as explained in the Petition, Côté's description of "'additional constraints [518]' to address local layout requirements discloses an 'initial distance required by an initial constraint' and a 'modification' to that constraint distance to address local layout requirements." *Id.* (citing Pet. 33–34; Ex. 1002 ¶¶ 168–171).

Next, RPX acknowledges that both the Petition and Dr. Nagel cite to Figure 6 of Côté as informing the meaning of additional constraints 518. Pet. Reply 12 (citing Pet. 33–34; Ex. 1002 ¶ 171). RPX, however, disagrees with IYM's assertion that Figure 6 is not applicable to constraints because its corresponding description does not mention constraints at all. *Id.* According to RPX, a person of ordinary skill in the art reading Côté, as a whole, would have understood that Figure 6 illustrates optimizing a layout by using the additional constraints that modify the initial constraint distances. *Id.* at 13 (citing Pet. 33–34; Ex. 1002 ¶¶ 168–171).

RPX further contends that the theoretical alternatives IYM proposes to Dr. Nagel during his cross-examination testimony are irrelevant because a person of ordinary skill in the art would have understood that Côté teaches computing additional constraints 518 in the manner required by independent claim 1. Pet. Reply 13. RPX also disagrees with IYM's argument that RPX's reading of Côté somehow contradicts Dr. Nagel's belief as to what is required by independent claim 1. *Id.* at 14. According to RPX, Dr. Nagel testified that the method step of "combining . . . local process modifications with constraint distances in [a] system of initial constraints" cannot be satisfied by forming an entirely new constraint that is not constructed from an initial constraint. *Id.* RPX then reiterates its argument that Côté's additional constraints 518 are constructed by combining local process

modifications determined from running simulations on layout 510 with the initial distances imposed by initial design rules 505 on the local area. *Id.* RPX argues that Dr. Nagel never said that an additional constraint constructed from an initial constraint does not satisfy independent claim 1 if that additional constraint is fed into an optimizer along with the initial constraint, and RPX asserts nothing in independent claim 1 excludes that possibility. *Id.*

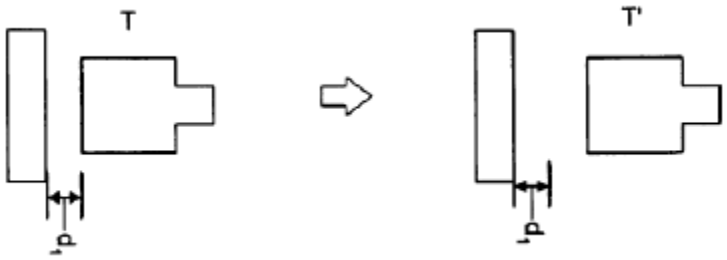
Lastly, RPX contends that IYM's reliance on the *Motorola* and *Zoltek* cases are inapposite. Pet. Reply 14. RPX argues that these two cases are distinguishable from the circumstances presented here because (1) *Motorola* was a case based on anticipation where the party solely relied on expert testimony to account for a limitation; and (2) *Zoltek* was a case that involved claims requiring a specific mathematical relationship missing from the asserted prior art. *Id.* (first citing *Motorola,* 121 F.3d at 1472–73; and then citing *Zoltek*, 815 F.3d at 1309–11). In contrast, RPX argues that it relies on specific teachings in Côté to account for the claimed "new local constraint distances," and it relies on Dr. Nagel's supporting testimony to explain how a person of ordinary skill in the art would have understood these teachings in Côté. *Id.* at 14-15 (citing Pet. 8, 32–35).

In its Sur-Reply, IYM reiterates its argument that Côté discloses certain constraints, such as area constraints and fixed edge positions, which do not involve or require constraint distances. PO Sur-Reply 6 (citing PO Resp. 37–40; Ex. 1004, 5:30–33; Ex. 1027, 19:16–24, 255:4–10, 279:11–282:22). In addition, IYM reiterates its argument that Côté's additional constraints 518 are not obtained "by combining . . . local process modifications with constraint distances in [a] system of initial constraints,"

as recited in independent claim 1. *Id.* at 6–7 (citing PO Resp. 40–41). According to IYM, RPX's theory of unpatentability requires Côté to disclose explicitly the claimed "new local constraint distances." *Id.* at 7. IYM asserts that it is not enough that Côté's additional constraints 518 can be constraint distances. *Id.*

Based on the record developed during trial, we agree with RPX and its declarant, Dr. Nagel, that Côté's additional constraints 518, which are constructed by combining the initial distances imposed by design rules 505 together with the local process modifications determined from running simulations on layout 510, teaches the claimed "new local constraint distances." As background, Côté explains that IC layouts generally are created using a set of design rules that specify certain constraints, "such as minimum spacings" (i.e., constraint distances). Ex. 1004, 1:58–63. Côté, however, explains that using design rules that specify a minimum spacing between certain shapes may lead to sub-optimal layouts. *Id.* at 2:5–7. Côté states that "[i]t may be preferable to use a larger spacing between shapes whenever possible to improve 'process latitude.'" *Id.* at 2:10–12.

As we explain previously, when addressing how Côté teaches the claimed "local process modifications," Côté discloses making changes to initial design rules 505 that result from running simulations on layout 510. Ex. 1004, 5:12–33, 6:9–17, 6:31–40, Figs. 5, 7. These changes to the initial design rules 505 are used to construct additional constraints 518, which, in turn, are fed into layout optimizer 520 to "further optimize[]" layout 510. *Id.* at 5:31–36, Fig. 5. The portion of Figure 6 of Côté, reproduced below, serves as one example of the layout optimization illustrated in Figure 5 of Côté. *Id.* at 3:57–59, 5:66–67.



This portion of Figure 6, reproduced above, illustrates original target layout T with two features spaced a certain distance d_1 apart and new target layout T' with the same two features "spaced further apart" that results in improved process latitude. *Id.* at 6:9–12. Based on this portion of Figure 6, we find that additional constraints imposed upon new target layout T' is a combination of the initial distance required by the original design rules (i.e., distance d_1) together with the local process modifications determined from running simulations on original target layout T (i.e., the increase in distance between the two features that results in improved process latitude).

Based on these and other disclosures in Côté, RPX's declarant, Dr. Nagel, testifies that "Côté describes how the 'additional constraints [518]' are determined from the local process modifications and from initial constraints." Ex. 1002 ¶ 170; *see also id.* ¶ 171 (testifying that "Côté describes that these new local constraint distances are constructed based on both the initial distances required by an initial constraint in a local area, as well as the local process modifications determined from the simulating" (citing Ex. 1004, 2:10–12, 6:9–17)). Dr. Nagel further testifies that Côté's additional constraints 518 constitute "new 'constraint distances' that are applied to the local area of the layout, which are thus 'new local constraint distances,' in the language of [independent] claim 1." *Id.* ¶ 170. We credit Dr. Nagel's testimony in this regard because it is consistent with Côté's

disclosure that additional constraints 518 are constructed by combining the initial distances imposed by design rules 505 together with the local process modifications determined from running simulations on layout 510.

We do not agree with IYM's argument that Côté's additional constraints 518 do not constitute the claimed "new local constraint distances" because Côté discloses some constraints that do not involve or require constraint distances. *See* PO Resp. 37–41; PO Sur-Reply 6–7. There is no dispute between the parties that the claim term "constraint" should be construed as "limits on geometry parameters of the layout objects in the design layout." *Compare* Pet. 28–29, *with* PO Resp. 14–17. During oral argument, the parties agreed that this claim term encompasses both minimum and maximum constraints. *See* Tr. 44:16–19 (explaining that independent claim 1 "does not limit the constraint distances to be a minimum or a maximum"), 45:1–10 (agreeing that the word "limits" referred to in the parties' agreed upon construction of the claim term "constraint" is not restricted to minimums or maximums), 99:13–15 (agreeing that independent claim 1 does not require minimum or maximum constraints).

As we explain above, Côté explains that IC layouts generally are created using a set of design rules that specify certain constraints, "such as minimum spacings" (i.e., constraint distances). Ex. 1004, 1:58–63. Indeed, the layout generation and enhancement process illustrated in Figure 5 of Côté provides one example of a constraint distance because it illustrates feeding additional constraints 518 into layout optimizer 520 to further optimize layout 510. *Id.* at 5:30–36, Fig. 5. Figure 6 of Côté provides another example of a constraint distance because it illustrates increasing the

distance between two features in new target layout T' to improve process latitude. *Id.* at 6:9–12, Fig. 6. The teachings of Côté identified above are consistent with the parties' agreed upon construction of the claim term "constraint" because the constraint distances taught by Côté (e.g., additional constraints 518 or distance increase between the two features in new target layout T') places minimum or maximum limits on geometry parameters of layout objects in a design layout (e.g., layout 510 or new target layout T').

We also do not agree with IYM's argument that Dr. Nagel's cross-examination testimony contradicts his initial testimony that Côté's additional constraints 518 constitute the claimed "new local constraint distances." *See* PO Resp. 41–42. To support this argument, IYM directs us to the following statement elicited from Dr. Nagel during cross-examination: "The 'combining said local process modifications with constraint distances in said system of initial constraints' does not mean adding additional constraints that were heretofore not in the system of initial constraints." Ex. 2013, 65:15–19. Although somewhat difficult to decipher, we do not understand Dr. Nagel to take the position that the aforementioned "combining" method step cannot be satisfied by adding an entirely new constraint to the system of initial constraints, as asserted by IYM. PO Resp. 42. Instead, a reasonable reading of this cited testimony is that constructing additional constraints requires determining the initial constraints imposed upon local areas of the design layout. This reading is consistent with Dr. Nagel's testimony accompanying the Petition. *See* Ex. 1002 ¶¶ 168–172.

Regardless of how we decipher the portion of Dr. Nagel's cross-examination testimony identified above, IYM treats this cross-examination testimony as though it was articulated and relied on by RPX in the Petition.

As we explain previously, we agree with RPX and Dr. Nagel that Côté's additional constraints 518, which are constructed by combining the initial distances imposed by design rules 505 together with the local process modifications determined from running simulations on layout 510, teach the claimed "new local constraint distances." We did not rely upon the aforementioned portions of Dr. Nagel's cross-examination testimony when determining whether the teachings of Côté account for this disputed limitation. Stated differently, the testimony elicited from Dr. Nagel during cross-examination does not undermine the evidence presented and developed by RPX in the Petition, or otherwise render Dr. Nagel's supporting testimony provided in the Declaration accompanying the Petition less persuasive.

Lastly, we do not agree with IYM's argument that RPX improperly relies on Dr. Nagel's testimony to fill gaps in the teachings of Côté. *See* PO Resp. 42–43. To support this argument, IYM directs us to the *Motorola* and *Zoltek* cases, both of which are distinguishable from the circumstances presented here. Beginning with *Motorola*, IYM relies on this case to support its assertion that we cannot rely on Dr. Nagel's testimony to supplant the teachings of Côté itself. *Motorola*, however, addressed a jury's invalidity findings and, in particular, whether an asserted prior art reference anticipated a claim of the involved patent. 121 F.3d at 1472. The Federal Circuit determined that the jury's verdict could not stand because it was impermissible to rely on an expert's conclusory testimony, unsupported by documentary evidence, to supplant the anticipatory disclosure of the asserted prior art reference itself. *Id.* at 1472–73. In contrast, the ground at issue here is one based on obviousness—not anticipation—over the teachings of

Côté. A proper obviousness evaluation requires us to consider Dr. Nagel's testimony explaining the teachings of Côté relied on by RPX from the perspective of a person of ordinary skill in the art. *See Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1361 n.3 (Fed. Cir. 2008) ("What a prior art reference discloses or teaches is determined from the perspective of one of ordinary skill in the art.").

Turning to *Zoltek*, the Federal Circuit determined that certain claims in a reissue patent were not rendered obvious because the expert testimony was replete with examples of impermissible hindsight reconstruction. 815 F.3d at 1309–14. In contrast, apart from a few unsupported assertions, IYM does not explain adequately how Dr. Nagel's testimony is distorted by hindsight or how it is based on *ex post* reasoning. Contrary to IYM's assertions, there is no need for Dr. Nagel to recreate the entire method step of "constructing new local constraint distances by combining . . . local process modifications with constraint distances in [a] system of initial constraints," as recited in independent claim 1. As we explain previously, Côté teaches this method step because additional constraints 518 are constructed by combining the initial distances imposed by design rules 505 together with the local process modifications determined from running simulations on layout 510.

d. IYM's Remaining Arguments

In its Patent Owner Response, IYM contends that Côté lacks sufficient details to render the challenged claims obvious. PO Resp. 48. To support this argument, IYM directs us to Côté's teachings with respect to process simulator 512, image analyzer 516, and layout optimizer 520, along with the cross-examination testimony of RPX's declarant, Dr. Nagel. *Id.* at

48–52 (citing Ex. 1004, 5:17–19, 5:30–34, Figs. 5, 7; Ex. 2013, 106:8–108:9, 110:11–112:18, 177:13–178:11, 182:18–24, 189:2–190:5; Ex. 2012 ¶¶ 95–99). IYM then asserts that Côté adds nothing to the image analysis used in the prior art hotspot fixing procedure that was recognized by a provisional filing of the '012 patent. *Id.* at 51 (citing Ex. 2014, 4–5[3]); *see also id.* at 52 (arguing that Côté "provides no technical advance over this prior art [hotspot fixing procedure]").

We do not agree that Côté's teachings lack sufficient detail to render the challenged claims obvious because, as we explain previously, Côté accounts for the limitations at issue, particularly when its teachings are viewed from the perspective of a person of ordinary skill in the art. To the extent IYM argues that the teachings of Côté cannot be used to render certain features of the challenged claims obvious because Côté is not directed to the same problem addressed by the '012 patent (i.e., fixing or eliminating hotspots in IC manufacturing), we also do not agree. *See* PO Resp. 48–52. It is well-settled that "[t]he use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned." *In re Heck*, 699 F.2d 1331, 1333 (Fed. Cir. 1983) (quoting *In re Lemelson*, 397 F.2d 1006, 1009 (CCPA 1968)); *see also EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985) ("A reference must be considered for everything that it *teaches* by way of technology and is not limited to the particular *invention* it is describing and attempting to protect."). As a result, it is incumbent upon

[3] All references to the page numbers in Exhibit 2014 refer to the page numbers inserted by IYM in the bottom, right-hand corner of each page.

us to consider Côté for everything it teaches, regardless if it does not state explicitly that its optimization addresses hotspots in IC manufacturing.

IYM also contends that a person of ordinary skill in the art cannot provide the limitations purportedly missing from Côté—namely, the claimed "local process modifications" and "new local constraint distances." PO Resp. 53–54 (citing Ex. 2012 ¶ 102). Stated differently, IYM contends that RPX has not provided any evidence that a person of ordinary skill in the art would have found it obvious to add the limitations that Côté purportedly lacks. *Id.* at 55.

We do not agree with IYM's arguments in this regard because, as we explain previously, it is permissible for RPX to rely on the teachings of Côté together with the supporting testimony of Dr. Nagel in analyzing obviousness. *See Monsanto*, 878 F.3d at 1346–47. Indeed, a proper obviousness evaluation requires us to consider Dr. Nagel's testimony explaining the teachings of Côté from the perspective of a person of ordinary skill in the art. *See Sundance*, 550 F.3d at 1361 n.3. With this in mind, we agree with RPX's arguments and evidence demonstrating that Côté teaches the claimed "local process modifications" and "new local constraint distances." *See supra* Section II.B.4.a–c.

e. Remaining Limitations

In its Patent Owner Response, IYM does not address separately whether Côté teaches the remaining limitations of independent claim 1. *See generally* PO Resp. 30–57. We have reviewed RPX's explanations and supporting evidence as to how Côté teaches these remaining limitations, and we agree with and adopt RPX's analysis. *See* Pet. 23–31, 35–38.

e. Summary

In summary, RPX has demonstrated by a preponderance of the evidence that the subject matter of independent claim 1 would have been obvious over the teachings of Côté.

5. Claims 2 and 3

Claim 2 depends from independent claim 1, and recites "wherein the layout received is organized in a single level." Ex. 1001, 8:36–37. Dependent claim 3 also depends from independent claim 1, and further recites "wherein the layout received is organized in a hierarchical data structure." *Id.* at 8:38–39.

In its Petition, RPX contends that a person of ordinary skill in the art would have understood that the claim term "single level" refers to a flat data structure. Pet. 58 (citing Ex. 1001, 3:6–10; Ex. 1002 ¶ 253). RPX also contends that a person of ordinary skill in the art would have understood that there are two well-known types of data structures for organizing data—namely, (1) a flat (single level) data structure; and (2) a hierarchical (nested) data structure. *Id.* (citing Ex. 1002 ¶ 254). For example, RPX asserts that Graphic Design System and Caltech Intermediate Form were well-known layout formats that could be both flat and hierarchical. *Id.* According to RPX, a person of ordinary skill in the art would have appreciated the merits of both formats, depending on his/her goals or priorities for a given implementation, and would have used well-known criteria to make a selection. *Id.* at 58–59 (citing Ex. 1002 ¶ 255).

RPX further contends that a person of ordinary skill in the art would have found it obvious for Côté's layout 510 to be either a flat or hierarchical layout format, and would have recognized the selection of one over the other

as a simple matter of design choice. Pet. 59 (citing Ex. 1002 ¶ 256). RPX argues that, even if a person of ordinary skill in the art would not have understood Côté to teach these layout formats, it would have been a conventional, expected, and obvious way for a person of ordinary skill in the art to format Côté's layout 510. *Id.*

In its Patent Owner Response, IYM does not address separately whether Côté teaches the limitations of dependent claims 2 and 3. *See generally* PO Resp. 30–62. We have reviewed RPX's explanations and supporting evidence as to how Côté teaches these limitations, and we agree with and adopt RPX's analysis. *See* Pet. 38, 58–59. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claims 2 and 3 would have been obvious over the teachings of Côté.

6. Claim 5

Claim 5 depends from independent claim 1, and recites "wherein the step of constructing initial constraints is accomplished using information comprising coordinates of said layout objects, design rules and circuit requirements." Ex. 1001, 8:44–47.

In its Petition, RPX directs us to its explanation and supporting evidence as to how Côté teaches constructing initial constraints imposed by design rules 505 in the context of independent claim 1. Pet. 38. RPX also contends that Côté teaches this limitation because it discloses constructing initial constraints with layout object coordinate information. *Id.* at 38–39 (citing Ex. 1004, 1:58–61, 2:1–4, 2:6–7, 2:41–44, Fig. 6; Ex. 1002 ¶¶ 189–192). Next, RPX contends that the '012 patent does not define circuit requirements nor does it disclose receiving circuit requirements. *Id.* at 39

(citing Ex. 1001, 3:5–11, 3:16–17, 3:36–37). Instead, RPX argues that the '012 patent merely discloses that constructing initial constraints from circuit requirements involves considering the geometries of layout objects in setting constraints based on circuit requirements. *Id.* (citing Ex. 1001, 3:36–42). RPX then argues that, to the extent initial constraints from circuit requirements require consideration of electrical characteristics, Côté teaches this limitation because it discloses determining "capacitance and resistance of wires" and producing "netlist" files that include "resistance and capacitance parameters." *Id.* at 40 (quoting Ex. 1004, 4:46–59). According to RPX, Côté's layout with built-in electrical characteristics produces the system of initial constraints required by dependent claim 5. *Id.* (citing Ex. 1002 ¶¶ 193, 194).

In its Patent Owner Response, IYM does not address separately whether Côté teaches the limitation of dependent claim 5. *See generally* PO Resp. 30–62. We have reviewed RPX's explanations and supporting evidence as to how Côté teaches this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 38–40. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 5 would have been obvious over the teachings of Côté.

7. Claim 13

Claim 13 depends from independent claim 1, and recites "wherein the system of initial constraints comprises linear constraints comprising minimal width, minimal space, minimal overlap, minimal enclosure, minimal extension, and fixed size." Ex. 1001, 9:16–19.

In its Petition, RPX contends that the claimed "linear constraints" are basic components of standard design rules that are well-known in the art.

Pet. 59 (citing Ex. 1002 ¶¶ 257–262). RPX further argues that Côté teaches this limitation because it discloses that IC layouts generally are created using a set of design rules that specify certain constraints, "such as minimum spacings or minimum line widths" and a "fixed" layout area. *Id.* (quoting Ex. 1004, 1:58–64, 5:44–46). RPX asserts that a person of ordinary skill in the art would have understood that all the claimed "linear constraints" are part of Côté's "initial constraints" imposed by design rules 505 and were disclosed in standard design rules long before the '012 patent. *Id.* at 59–60 (citing Ex. 1002 ¶¶ 260–262).

In its Patent Owner Response, IYM does not address separately whether Côté teaches the limitation of dependent claim 13. *See generally* PO Resp. 30–62. We have reviewed RPX's explanations and supporting evidence as to how Côté teaches this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 38, 59–60. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 13 would have been obvious over the teachings of Côté.

8. Claim 14

Claim 14 depends from independent claim 1, and recites "wherein the step of enforcing new local constraint distance comprises applying a heuristic search procedure." Ex. 1001, 9:20–22.

In its Petition, RPX contends that, unlike optimization, "a heuristic search procedure" may not generate an optimal outcome. Pet. 40 (citing Ex. 1002 ¶¶ 196–198). RPX argues that a person of ordinary skill in the art would have known that heuristic solutions, as recognized by Chen's "single-error removal procedure" disclosed in the '012 patent, are alternatives to optimization. *Id.* (citing Ex. 1001, 4:49). Relying on the testimony of

Dr. Nagel, RPX argues that heuristic procedures were well-known in the art of computer-implemented IC layouts. *Id.* (citing Ex. 1002 ¶ 198). RPX asserts that a person of ordinary skill in the art would have recognized that using a heuristic search procedure to enforce a new local constraint distance in lieu of Côté's optimization would have been a matter of design choice. *Id.*

In its Patent Owner Response, IYM contends that Côté does not teach the claimed "heuristic search procedure." PO Resp. 58. IYM argues that Côté discloses layout optimizer 520, but does not provide any details regarding its structure or operation. *Id.* (citing Pet. 7, 36, 43, 53; Ex. 1002 ¶¶ 179, 200, 228; Ex. 2013, 215:13–21). In addition, IYM argues that RPX's declarant, Dr. Nagel, purportedly agreed that Côté does not teach the claimed "heuristic search procedure" because, during his deposition, he stated that "[n]owhere in . . . the Côté patent is there a description of a heuristic search procedure, no." *Id.* (quoting Ex. 2013, 214:25–215:2) (citing Ex. 2012 ¶ 107).

IYM further contends that it would not have been obvious to substitute optimization performed by Côté's layout optimizer 520 with a heuristic search procedure. PO Resp. 58. According to IYM, the only evidence that might support such a conclusion for obviousness comes from the '012 patent itself. *Id.* at 59 (citing Pet. 40; Ex. 2012 ¶ 108). IYM argues that the '012 patent's own disclosure cannot support such a conclusion of obviousness because the disclosure in question is found in the description of the preferred embodiment of the invention—not in the background section. *Id.* at 59–60.

Lastly, IYM disagrees with RPX's contention that substituting a heuristic search procedure for the optimization performed by Côté's layout optimizer 520 would have been a matter of design choice. PO Resp. 60. IYM reiterates that Côté does not mention heuristic search procedures, but rather relies on well-known optimization methods to address problems formulated in terms of linear constraints. *Id.* IYM argues that the Petition does not cite to a single piece of evidence outside the '012 patent that would have provided the necessary motivation for a person of ordinary skill in the art to use a heuristic search procedure in lieu of the optimization performed by Côté's layout optimizer 520. *Id.* at 61. IYM recognizes that Dr. Nagel's supporting testimony references Allan as teaching a heuristic search procedure, but IYM asserts that Allan is not part of the instituted grounds in this proceeding, nor did Dr. Nagel explain how or why a person of ordinary skill in the art would have combined the teachings of Côté with those of Allan. *Id.* (citing Ex. 1015; Ex. 2012 ¶ 111).

In its Reply, RPX contends that IYM mischaracterizes its argument regarding how Côté renders dependent claim 14 obvious. Pet. Reply 25. RPX argues that it did not rely on any statement in the '012 patent for motivation to use heuristic search procedures in Côté, but rather it relied on the fact that using such procedures was a known design choice for layout optimization, as evidenced by Allan. *Id.* (citing Pet. 40; Ex. 1002 ¶ 198). Contrary to IYM's assertions, RPX argues that it is permissible for it to rely on the teachings of Allan, even though Allan is not part of the instituted grounds in this proceeding, because it serves as evidence of the general background knowledge of a person of ordinary skill in the art. *Id.*

In its Sur-Reply, IYM contends that RPX's argument that heuristic search procedures were well-known in the prior art is not enough for purposes of demonstrating obviousness. PO Sur-Reply 9. IYM argues that RPX cannot rely on the conclusory testimony of Dr. Nagel to support its argument that using a heuristic search procedure "would have been a matter of design choice." *Id.* at 10. IYM also argues that RPX cannot hide behind the fact that Allan is evidence of the general background knowledge of a person of ordinary skill in the art to avoid providing the explanation and evidentiary support that RPX would have been obligated to provide if Allan was part of the instituted grounds in this proceeding. *Id.*

Based on the record developed during trial, we agree with RPX that heuristic search procedures were old and well-known in the art, and a person of ordinary skill in the art would have recognized that such a procedure was a viable substitute for the optimization performed by Côté's layout optimizer 520. We begin our analysis by noting that dependent claim 14 does not require a specific heuristic search procedure because it simply states, in relevant part, "a heuristic search procedure." Ex. 1001, 9:21–22. Outside of dependent claim 14, the word "heuristic procedures" appears in the specification of the '012 patent only once. For convenience, the relevant portion of the specification is reproduced below.

> In another preferred embodiment, the violations to local constraints are removed one at a time using *heuristic procedures*. For example, the single error removal procedure described by Zhan Chen in "Layout and Logic Techniques for Yield and Reliability Enhancement", Ph.D. Thesis, University of Massachusetts Amherst, 1998, can be applied to fix isolated violations. It is particularly useful when processing hotspots are few.

Id. at 4:47–54 (emphasis added). This portion of the specification indicates that Chen's "single error removal procedure," which is admitted prior art to the '012 patent regardless of the fact the disclosure cited above appears in the detailed description, is a heuristic search procedure that is capable of being used to remove violations to local constraints in an IC layout. The specification does not include any other discussions of heuristic search procedures, examples of what those might be, or how they operate in the context of the claimed invention.

Based on the aforementioned disclosure in the specification of the '012 patent, we agree with RPX and Dr. Nagel that heuristic search procedures were old and well-known in the art of computer-implemented IC layout, as evidenced by Chen's "single error removal procedure." Pet. 40; Ex. 1002 ¶ 198. Taking this general background knowledge of one of ordinary skill in the art, we agree with RPX that it would have been a matter of design choice to substitute the optimization performed by Côté's layout optimizer 520 with a heuristic search procedure, such as Chen's "single error removal procedure." *See* Pet. 40. The evidence of record suggests that implementing Chen's "single error removal procedure" in a computer-implemented IC layout, as taught by Côté, would not have been uniquely challenging or otherwise beyond the skill level of an ordinary skilled artisan. *See Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 418). The record before us does not include credible evidence to the contrary.

We do not agree with IYM's argument that the '012 patent's disclosure regarding Chen's "single error removal procedure" cannot be treated as admitted prior art because this disclosure is found in the detailed

description section of the ’012 patent—not in the background or prior art section. *See* PO Resp. 59–60. It is well settled that admissions in a specification regarding prior art are not limited to a particular section of the specification. *See, e.g.*, *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1362 (Fed. Cir. 2007) (“Admissions in the specification regarding the prior art are binding on the patentee for purposes of a later inquiry into obviousness.”); *In re Nomiya*, 509 F.2d 566, 571 (CCPA 1975) (holding applicant’s labeling of two figures in the application drawings as “prior art” to be an admission that what was pictured was prior art relative to applicant’s improvement). Nevertheless, during oral argument, when questioning IYM’s counsel as to how Chen should be treated in the context of an obviousness evaluation of dependent claim 14, IYM’s counsel stated, “to be clear, Chen is prior art.” Tr. 73:7–15. In our view, this statement is an admission that Chen qualifies as admitted prior art and, therefore, is binding on IYM in this obviousness inquiry. *See Riverwood Int’l Corp. v. R.A. Jones & Co.*, 324 F.3d 1346, 1354 (Fed. Cir. 2003) (“Valid prior art may be created by the admissions of the parties.”).

There is another reason we agree with RPX that heuristic search procedures were old and well-known in the art and, a person of ordinary skill in the art would have recognized that such a procedure is a viable substitute for the optimization performed by Côté’s layout optimizer 520. When addressing dependent claim 14, Dr. Nagel testifies that Allan’s “heuristic approach to adjusting a layout to account for local conditions” serves as evidence that heuristic search procedures are old and well-known in the art of IC layouts. Ex. 1002 ¶ 198 (citing Ex. 1015). Allan, which is titled “Computer-Aided Design of Integrated Circuits and Systems,” was

published in November 1992 and, therefore, qualifies as prior art to the '012 patent. Ex. 1015, Title page. Allan discloses that its "LocDes Program" "uses a heuristic algorithm that makes adjustments iteratively such that changes in layout geometry occur in a number of small steps." *Id.* at 1356.

Although IYM is correct that Allan was not part of the instituted grounds in this proceeding (PO Resp. 61; PO Sur-Reply 10), it is still incumbent upon us to consider its evidentiary value. The Federal Circuit has recognized that evidence submitted with the Petition may be considered to demonstrate the knowledge that one of skill in the art "would bring to bear in reading the prior art identified as producing obviousness." *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015); *see also Randall Mfg. v. Rea*, 733 F.3d 1355, 1362–63 (Fed. Cir. 2013) (emphasizing that additional prior art references or evidence are not for the purpose of changing the prior art combination that forms the basis of the asserted ground, but rather are merely for the purpose of providing evidence of the state of the art, including the general background knowledge of a person of ordinary skill in the art). Here, we view Allan, particularly its disclosure of using a heuristic algorithm in the context of computer-aided design of ICs, to fall within the purview of permissible evidence we may consider in our obviousness evaluation of dependent claim 14. Upon considering this evidence, we agree with RPX that it would have been a matter of design choice to substitute the optimization performed by Côté's layout optimizer 520 with a heuristic search procedure, such as the heuristic algorithm used by Allan's LocDes Program. *See* Pet. 40; Ex. 1002 ¶ 198; Ex. 1015, 1356.

In summary, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 14 would have been obvious over the teachings of Côté and the general background knowledge of one of ordinary skill in the art.

C. Obviousness Over the Combined Teachings of Côté and Bamji

RPX contends that claims 1–3, 5, 10, 11, and 13 of the '012 patent are unpatentable under § 103(a) over the combined teachings of Côté and Bamji. Pet. 41–60. RPX explains how this proffered combination teaches or suggests the subject matter of each challenged claim, and provides reasoning as to why one of ordinary skill in the art would have been prompted to modify or combine the teachings of these references. *Id.* RPX also relies on the Declaration of Dr. Nagel to support its positions. Ex. 1002 ¶¶ 200–263. In its Patent Owner Response, IYM contends that Bamji does not remedy the deficiencies in the teachings of Côté identified above in the ground based on obviousness over Côté alone. PO Resp. 62–64. IYM relies upon the Declaration of Dr. Bernstein to support its positions. Ex. 2012 ¶¶ 113–115.

We begin our analysis with a brief overview of Bamji, and then we address the parties' contentions with respect to the claims at issue in this asserted ground.

1. Bamji Overview

Bamji generally relates to the field of computer aided design and the analysis of structural systems, such as ICs. Ex. 1005, 1:11–13. In particular, Bamji discloses methods and systems for optimizing performance criteria, such as fabrication yield for ICs. *Id.* at 1:13–15. As background, Bamji discloses that conventional methods for improving yield fall into the

following two categories: (1) layout topology is changed to improve yield; and (2) layout topology is fixed. *Id.* at 1:44–65. These methods, however, cannot be extended to other performance objectives. *Id.* at 1:66–2:1. According to Bamji, "[t]his problem of simultaneous optimization of multiple criteria is especially difficult to solve." *Id.* at 2:7–8.

Bamji solves this and other problems by providing a method, system and product "that guarantees an optimized yield for an [IC]." Ex. 1005, 2:21–23. The method and system "provide optimized yield for a fixed size IC, or alternatively, provide the maximum number of good IC's per wafer by increasing the size of the IC." *Id.* at 2:23–26. The method and system also "may be used to simultaneously optimize any number of performance criteria that have convex cost functions." *Id.* at 2:26–29. Bamji further discloses that its mathematical models "describe[] . . . performance criteria for the IC, such as defect probabilities for yield, power consumption, cross-talk delay, and the like," with each model relying on "spacing between layout objects." *Id.* at 2:57–62.

Figure 1 of Bamji, reproduced below, illustrates a system for optimizing fabrication yield in accordance with one embodiment. Ex. 1005, 4:38–40.

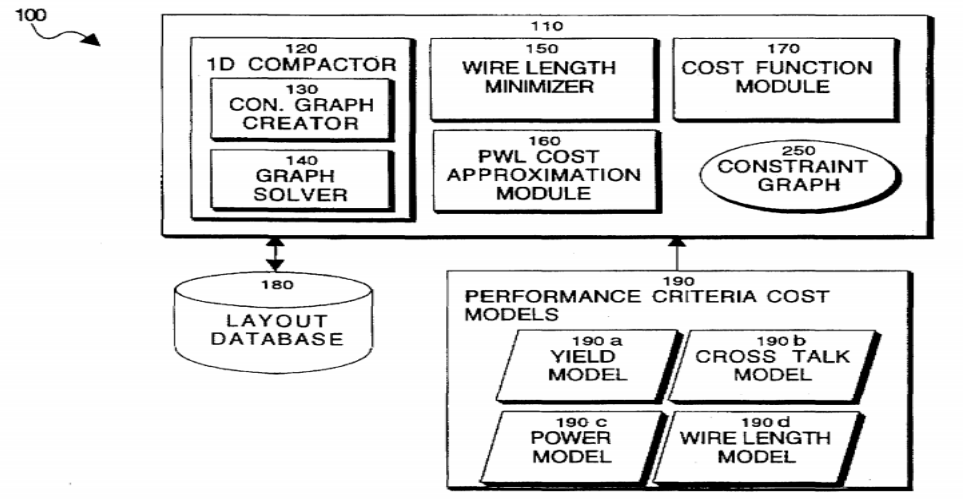


FIGURE 1

Figure 1, reproduced above, illustrates computer aided design system 100. Ex. 1005, 5:6–8. Computer aided design system 100 includes, among other things, compactor 120 that contains constraint graph creator 130 and graph solver 140. *Id.* at 5:43–44. Constraint graph creator 130 "reads a structural description of an [IC] from the layout database 180 and creates a constraint graph 250" (not illustrated in Fig. 1) using conventional techniques. *Id.* at 5:44–49. Graph solver 140 compacts constraint graph 250, "thereby produc[ing] a dimensionally minimized layout of the [IC]." *Id.* at 5:50–52.

2. Claim 1

In its Petition, RPX relies on essentially the same analysis discussed above in the ground based on obviousness over Côté alone to teach all the limitations of independent claim 1. Pet. 48–54 (citing Ex. 1002 ¶¶ 210, 211). RPX also argues that the teachings of Bamji may be used to supplement the teachings of Côté to account for certain limitations of independent claim 1—namely, both "constructing" steps, the "enforcing" step, the "updating" step, and the "whereby" clause. *Id.* (citing Ex. 1005,

2:47–49, 5:25–36, 8:6–42, 20:40–41, Figs. 5a, 5b). In particular, with respect to the "whereby" clause, RPX asserts that Bamji teaches this limitation because it optimizes a constraint graph for yield *and* other performance criteria. *Id.* at 54 (citing Ex. 1005, 2:57–62). Relying on the testimony of Dr. Nagel, RPX asserts that one of ordinary skill in the art would have understood that the combined teachings of Côté and Bamji produce a new layout that has increased yield and performance. *Id.* (citing Ex. 1002 ¶ 234).

Turning to the rationale to combine the teachings of Côté and Bamji, RPX contends that, although Côté teaches optimization, it does not teach a particular optimization technique. Pet. 43 (citing Ex. 1002 ¶ 200). Bamji, however, teaches an optimization technique that simultaneously optimizes multiple performance objectives, as opposed to an approach that merely optimizes yield. *Id.* at 44 (citing Ex. 1005, 2:6–7, 2:28–30, 2:57–62). Relying on the testimony of Dr. Nagel, RPX asserts that one of ordinary skill in the art would have understood that Bamji's constraint graph optimization technique would be well-suited for Côté's layout optimizer 520. *Id.* (citing Ex. 1002 ¶¶ 201, 202). RPX argues that one of ordinary skill in the art would have been motivated to use Bamji's constraint graph optimization technique with Côté's layout optimizer 520 to provide simultaneous optimization of multiple performance criteria. *Id.* (citing Ex. 1002 ¶ 202). Stated differently, RPX argues that, although one of ordinary skill in the art would have recognized that optimizing for yield would be important, as taught by Côté, it also would have been desirable to optimize for IC performance like power consumption, cross-talk, wire length, and the like, as taught by Bamji. *Id.* Lastly, RPX asserts that one of ordinary skill in the

art would have appreciated that the teachings of Côté and Bamji are compatible, and then reiterates that Bamji's constraint graph optimization technique could be used as the specific form of optimization employed by Côté's layout optimizer 520. *Id.* at 44–45 (citing Ex. 1002 ¶ 203).

In its Patent Owner Response, IYM contends that Bamji does not remedy Côté's purported failure to teach "computing local process modifications" and "constructing new local constraint distances by combining said local process modifications with constraint distances in [a] system of initial constraints," as recited in independent claim 1. PO Resp. 62 (citing Ex. 2012 ¶ 113). IYM argues that Bamji teaches conventional optimization techniques using only global constraints—not local constraints. *Id.* at 62–63 (citing Ex. 1005, 8:24–26, 12:26–28). To support this argument, IYM directs us to various excerpts of Dr. Nagel's cross-examination testimony, where he purportedly confirmed that Bamji only relies on global design rules. *Id.* at 63 (citing Ex. 1002 ¶ 205; Ex. 2013, 220:9–13, 221:25–222:2, 225:7–13; Ex. 2012 ¶ 14). IYM then asserts that, because Bamji only applies global design rules, it cannot remedy Côté's failure to teach the claimed "local process modifications" and "new local constraint distances." *Id.*

As we explain above in the ground based on obviousness over Côté alone, Côté teaches the claimed "local process modifications" and "new local constraint distances." *See supra* Section II.B.4.a–e. Consequently, there are not deficiencies with respect to these claim features in the teachings of Côté for Bamji to remedy. To the extent IYM argues that RPX cannot rely on Bamji to teach the claimed "new local constraint distances" because Bamji only applies global design rules, this argument ignores or

fails to appreciate RPX's reliance on the teachings of Côté. *See* PO Resp. 62–64. As we explain previously, Côté's additional constraints 518, which are constructed by combining the initial distances imposed by design rules 505 together with the local process modifications determined from running simulations on layout 510, teaches the claimed "new local constraint distances." *See supra* Section II.B.4.c. In its ground based on obviousness over the combined teachings of Côté and Bamji, RPX contends that, when Bamji's constraint graph optimization technique is implemented by Côté's layout optimizer 520, Bamji's constraint graph would be modified based on Côté's additional constraints 518. Pet. 50 (citing Ex. 1002 ¶ 222). At no point in this asserted ground does RPX argue that Bamji, by itself, teaches the claimed "new local constraint distances." *See id.* at 50–51.

We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté and Bamji account for the limitations of independent claim 1, as well as RPX's reasoning as to why one of ordinary skill in the art would have been prompted to modify their respective teachings, and we agree with and adopt RPX's analysis. *See* Pet. 43–45, 48–54. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of independent claim 1 would have been obvious over the combined teachings of Côté and Bamji.

3. Claims 2, 3, and 13

RPX relies on the same analysis discussed above in the ground based on obviousness over Côté alone to teach the limitations of dependent claims 2, 3, and 13. Pet. 55, 58–60. In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté and Bamji account for the limitations of dependent claims 2, 3, and 13. *See generally*

PO Resp. 62–64. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté and Bamji account for these limitations, and we agree with and adopt RPX's analysis. *See* Pet. 55, 58–60. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claims 2, 3, and 13 would have been obvious over the combined teachings of Côté and Bamji.

4. Claim 5

In its Petition, RPX directs us to its explanation and supporting evidence as to how the combined teachings of Côté and Bamji account for constructing initial constraints using design rules in the context of independent claim 1. Pet. 55. RPX contends that Bamji's layout database 180 includes structural descriptions of an IC, layout objects, and the coordinates of the layout objects, all of which are used to build a constraint graph. *Id.* (citing Ex. 1005, 5:18–31, 8:7–10, 8:23–26). RPX then argues that, to the extent the claimed "circuit requirements" are determined from geometries, Bamji teaches this limitation because it discloses setting initial constraints based on geometries of layout objects. *Id.* Alternatively, RPX argues that, to the extent the claimed "circuit requirements" require consideration of electrical characteristics, Bamji teaches this limitation because it provides for consideration of circuit requirements (e.g., power consumption) when constructing initial constraints. *Id.* at 56 (citing Ex. 1005, 6:11–15, 7:18–22; Ex. 1002 ¶ 242). RPX asserts that a person of ordinary skill in the art would have understood that, to make use of Bamji's power consumption model 190c, electrical characteristics would be considered in building its constraint graphs. *Id.* (citing Ex. 1002 ¶¶ 237–242).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté and Bamji account for the limitation of dependent claim 5. *See generally* PO Resp. 62–64. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté and Bamji account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 55–56. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 5 would have been obvious over the combined teachings of Côté and Bamji.

5. Claim 10

Claim 10 depends from independent claim 1, and recites "wherein the step of enforcing new local constraint distances comprises optimizing a predefined objective function for optimizing measurable performance of a layout, subject to said new local constraint distances." Ex. 1001, 8:66–9:3.

In its Petition, RPX contends that the Côté and Bamji combination would have used Bamji's constraint graph optimization technique and, as a result, this combination teaches the limitation of dependent claim 10. Pet. 56. RPX argues that Bamji discloses minimizing one or more "predefined" cost functions (i.e., a function of the "spacing between two layout objects"), including cost functions derived from performance models that include power consumption, wire length, cross-talk, etc. *Id.* (quoting Ex. 1005, 7:34–52) (citing Ex. 1005, 2:57–62, 3:1–15). RPX further argues that Bamji discloses that the cost functions account for the distances specified by the design rules. *Id.* (citing Ex. 1005, 8:23–30). RPX then asserts that, in the Côté and Bamji combination, a person of ordinary skill in the art would have understood that Côté's additional constraints 518 would have been combined

with the initial constraints in Bamji's constraint graph to yield new enforceable constraints. *Id.* at 56–57.

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté and Bamji account for the limitation of dependent claim 10. *See generally* PO Resp. 62–64. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté and Bamji account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 56–57. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 10 would have been obvious over the combined teachings of Côté and Bamji.

6. Claim 11

Claim 11 depends from independent claim 1, and recites the following:

> wherein the step of enforcing new local constraint distances comprises receiving coefficients for an objective function selected from a group consisting of objective function for legalizing the layout with minimal changes from the original layout, objective function for minimizing, and objective function for minimizing the layout area, subject to said new local constraint distances.

Ex. 1001, 9:4–10.

In its Petition, RPX contends that dependent claim 11 is written in Markush format because it recites "selected from a group consisting of" and, therefore, the combined teachings of Côté and Bamji need only account for one of the listed objective functions to render this claim obvious. Pet. 57. RPX argues that both Côté and Bamji teach the claimed "objective function for minimizing the layout area" because they both teach compaction, and

RPX further emphasizes Bamji's disclosure of receiving "coefficients for" an objective function. *Id.* (citing Ex. 1004, 2:62–64, 5:50–51; Ex. 1005, 5:51–53, 9:39–50, 15:53–57, Table 1; Ex. 1002 ¶ 250).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté and Bamji account for the limitation of dependent claim 11. *See generally* PO Resp. 62–64. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté and Bamji account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 57. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 11 would have been obvious over the combined teachings of Côté and Bamji.

D. Obviousness Over the Combined Teachings of Côté, Bamji, and Kroyan

RPX contends that claims 4 and 6–9 of the '012 patent are unpatentable under § 103(a) over the combined teachings of Côté, Bamji, and Kroyan. Pet. 60–68. In support of its contentions, RPX explains how this proffered combination teaches or suggests the subject matter of each challenged claim, and provides reasoning as to why one of ordinary skill in the art would have been prompted to modify the teachings of these references. *Id.* RPX also relies on the Declaration of Dr. Nagel to support its positions. Ex. 1002 ¶¶ 264–304. By virtue of their dependency, IYM contends that claims 4 and 6–9 include all the limitations of independent claim 1 and, therefore, these claims are patentable over the combined teachings of Côté, Bamji, and Kroyan for the same reasons discussed above

with respect to the grounds based on obviousness over the teachings of Côté alone and the combined teachings of Côté and Bamji. PO Resp. 64–65.

We begin our analysis with a brief overview of Kroyan, and then we address RPX's contentions with respect to the claims at issue in this asserted ground.

1. Kroyan Overview

Kroyan generally relates to a system and method for designing ICs fabricated by a semiconductor manufacturing process and, in particular, to designing ICs to enhance manufacturability and improve yield. Ex. 1006, 1:22–28. Figure 3 of Kroyan, reproduced below, illustrates a method for IC design in accordance with one embodiment. *Id.* at 4:43–45.

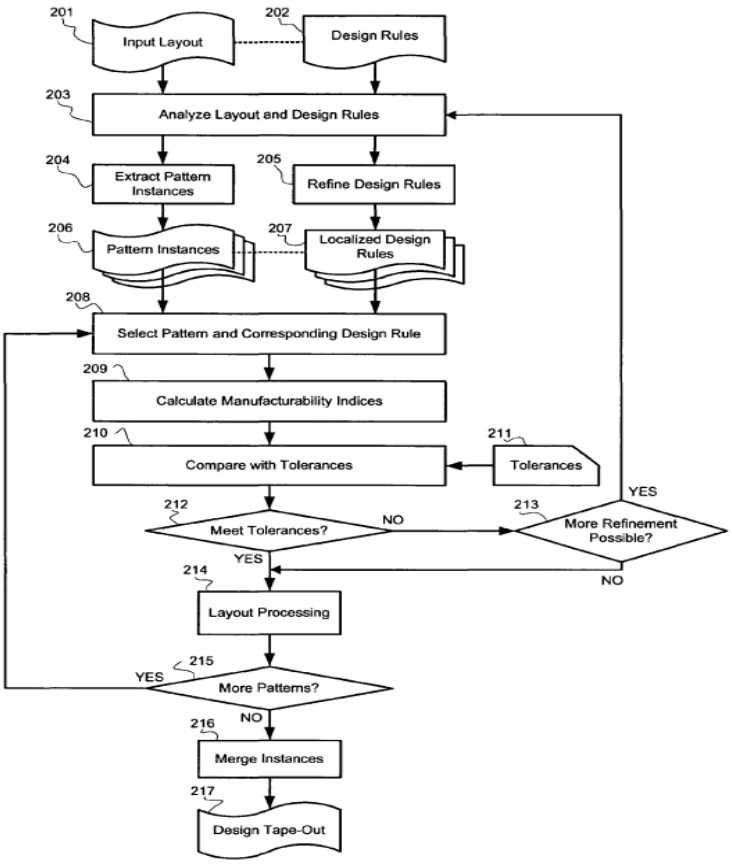


Figure 3

Figure 3 of Kroyan, reproduced above, illustrates that, at step 203, analysis engine receives input layout 201 and design rules 202. *Id.* at 5:63–66. The analysis engine evaluates the layout and design rules by determining distinct pattern types that "have different criticality leading to different manufacturability margin requirements." *Id.* at 6:4–7. In step 204, certain pattern instances 206 are extracted. *Id.* at 6:17–18. Similarly, at step 205, localized design rules are produced that correspond to each extracted pattern instance. *Id.* at 6:18–20. At step 208, each pattern instance and localized design rule is selected for an evaluation of manufacturability indices at step 209. *Id.* at 6:20–23. At step 210, the results of calculating the manufacturability indices are compared against past tolerances 211. *Id.* at 6:30–31. In step 212, if the results are within the tolerances, the selected design rules are suitable for the given pattern instances. *Id.* at 6:31–34. The process then proceeds to step 214, where the layout is processed according to these selected design rules. *Id.* at 6:34–35. At step 213, if more refinement is needed, the process returns to step 203 for further analysis. *Id.* at 6:35–39.

Figure 9 of Kroyan, reproduced below, illustrates a flow diagram of an intelligent analysis and optimization resolution enhancement technique in accordance with another embodiment. Ex. 1006, 4:62–64.

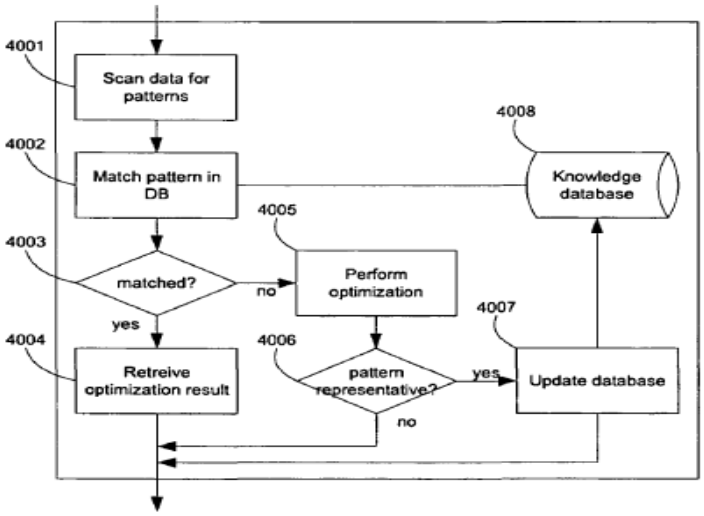


Figure 9

Figure 9 of Kroyan, reproduced above, illustrates that, at step 4001, the input design layout first is scanned and, at step 4002, the output layout patterns are compared against data stored in database 4008. *Id.* at 9:1–5. At step 4003, if a match is found, an optimization result is retrieved at step 4004. *Id.* at 9:6–7. At step 4005, if a match is not found, then a decision is made whether to store the results in the database at step 4006. *Id.* at 9:7–11. If the results are stored, database 4008 is updated at step 4007. *Id.* at 9:11–12.

2. Claim 4

Claim 4 depends from independent claim 1, and recites "wherein said description of manufacturing process comprises design rules, simulation models, equipment settings, material selections, and look-up data tables." Ex. 1001, 8:40–43.

In its Petition, RPX contends that the combined teachings of Côté, Bamji, and Kroyan account for this limitation because Côté discloses design rules, simulation models, equipment settings, and material selections, Bamji provides additional disclosures of design rules and simulation models, and

Kroyan discloses the same features along with material selections. Pet. 64 (citing Ex. 1004, 5:12–14, 5:17–29; Ex. 1005, 6:11–15, 8:25–26; Ex. 1006, 5:62–66, 9:34–36, 9:41–46; Ex. 1002 ¶¶ 271, 272). Based on the disclosures in all three references, RPX argues that a person of ordinary skill in the art would have understood that physical models include material selections, such as the type of photoresist or etchant. *Id.* (citing Ex. 1002 ¶ 273). RPX further argues that Kroyan discloses receiving look-up data tables because it uses a knowledge database to evaluate a layout and "comput[e] local process modifications." *Id.* at 64–65 (citing Ex. 1006, 8:57–9:17, 10:46–58, 11:55–12:3; Ex. 1002 ¶¶ 274–279).

Turning to the rationale to combine the teachings of Côté, Bamji, and Kroyan, RPX contends that it would have been obvious to a person of ordinary skill in the art to combine the teachings of Côté and Bamji with those of Kroyan because Kroyan adds an efficiency to the optimization process by disclosing a database that stores both pattern instances for weak spots in a layout and previously-determined optimization techniques for addressing those weak spots. Pet. 62 (citing Ex. 1006, 9:1–14). According to RPX, if a given layout does not match a pattern instance, Kroyan discloses determining another optimization technique and storing the information regarding the layout change. *Id.* (citing Ex. 1006, 9:1–14, 11:55–12:3). RPX asserts that a person of ordinary skill in the art would have appreciated that Kroyan's knowledge database that stores layout patterns would improve the efficiency of the optimization technique taught by the combination of Côté and Bamji because the knowledge database would provide the opportunity to re-use previously determined optimization techniques for future layouts. *Id.* (citing Ex. 1002 ¶ 266). RPX also

contends that a person of ordinary skill in the art would have recognized that Kroyan's approach for identifying weak spots in a design layout would be more efficient than evaluating a layout, as a whole, because Kroyan discloses evaluating the layout for weak spots at "discrete evaluation points." *Id.* (quoting Ex. 1006, 9:60–10:8) (citing Ex. 1002 ¶ 267).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté, Bamji, and Kroyan account for the limitation of dependent claim 4. *See generally* PO Resp. 64–65. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté, Bamji, and Kroyan account for this limitation, as well as RPX's reasoning as to why one of ordinary skill in the art would have been prompted to modify their respective teachings, and we agree with and adopt RPX's analysis. *See* Pet. 61–62, 64–65. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 4 would have been obvious over the combined teachings of Côté, Bamji, and Kroyan.

3. Claim 6

Claim 6 depends from independent claim 1, and recites "wherein calculating local process modification comprises detecting processing hotspots, evaluating process response variables in the neighborhood of said processing hotspots, and calculating local process modification values using a predetermined function of said process response variables." Ex. 1001, 8:48–53.

In its Petition, RPX contends that Kroyan teaches the claimed "detecting processing hotspots" because it discloses identifying weak spots in a design layout, such as those associated with placement error. Pet. 66

(citing Ex. 1006, 4:4–22, 7:26–40, 10:26–35; Ex. 1002 ¶¶ 281–283). RPX also contends that Kroyan teaches the claimed "evaluating process response variables in the neighborhood of said processing hotspots, and calculating local process modification values using a predetermined function of said process response variables" because Kroyan's weak spots are analyzed to determine "associated non-compliance properties," after which Kroyan "calculates functional relationships between non-compliant manufacturability parameters and layout parameters." *Id.* (quoting Ex. 1006, 10:26–35, 11:30–35) (citing Ex. 1002 ¶ 284). According to RPX, Kroyan discloses that these functional relationships are used to determine "possible combinations of layout modification instructions that have an influence on the non-compliant manufacturability parameter." *Id.* (quoting Ex. 1006, 11:44–54) (citing Ex. 1002 ¶ 285).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté, Bamji, and Kroyan account for the limitation of dependent claim 6. *See generally* PO Resp. 64–65. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté, Bamji, and Kroyan account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 65–66. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 6 would have been obvious over the combined teachings of Côté, Bamji, and Kroyan.

4. Claim 7

Claim 7 depends from independent claim 1, and recites "wherein local process modifications are calculated using simulation models at plurality of control points in the interaction region of a plurality of layout objects that are interrelated through constraints." Ex. 1001, 8:54–57.

In its Petition, RPX contends that Kroyan teaches this limitation because it discloses identifying weak spots in a design layout by evaluating manufacturability parameters at "discrete evaluation points." Pet. 67 (quoting Ex. 1006, 9:54–10:8) (citing Ex. 1002 ¶¶ 288, 289). RPX argues that Kroyan's "discrete evaluation points" relate to layout objects that are subject to constraints imposed by design rules because they are used to analyze a layout at a desired level of granularity. *Id.* (citing Ex. 1002 ¶¶ 290, 291). According to RPX, because the combination of Côté, Bamji, and Kroyan would incorporate Kroyan's approach for identifying weak spots in a design layout into Côté's approach for identifying problem areas in a design layout, the proffered combination teaches the limitation of dependent claim 7. *Id.* (citing Ex. 1002 ¶ 292).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté, Bamji, and Kroyan account for the limitation of dependent claim 7. *See generally* PO Resp. 64–65. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté, Bamji, and Kroyan account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 66–67. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 7 would have been obvious over the combined teachings of Côté, Bamji, and Kroyan.

5. Claim 8

Claim 8 depends from independent claim 1, and recites "wherein local process modifications are calculated from simulated local printability comprising edge placement error, light intensity during lithography exposure, and their derivatives from a plurality of layout objects that are interrelated through constraints." Ex. 1001, 8:58–62.

In its Petition, RPX contends that Kroyan teaches this limitation because it discloses printability characteristics, placement error, and light intensity during lithography exposure. Pet. 67 (citing Ex. 1006, 2:5–10, 6:42–47, 7:26–40, 9:41–46, 9:54–10:8, 11:44–54; Ex. 1002 ¶ 294). RPX asserts that a person of ordinary skill in the art would have understood that Kroyan's parameters, such as depth of focus and exposure latitude, amount to characteristic parameters of the lithography process. *Id.* at 67–68. RPX also contends that Kroyan teaches the claimed "derivatives." *Id.* at 68 (citing Ex. 1002 ¶ 297).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté, Bamji, and Kroyan account for the limitation of dependent claim 8. *See generally* PO Resp. 64–65. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté, Bamji, and Kroyan account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 67–68. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 8 would have been obvious over the combined teachings of Côté, Bamji, and Kroyan.

6. Claim 9

Claim 9 depends from independent claim 1, and recites "wherein the step of computing local process modification comprises searching a look-up data table." Ex. 1001, 8:63–65.

In its Petition, RPX contends that Kroyan teaches this limitation because, when addressing a design layout with problematic weak spots, Kroyan discloses using its knowledge database to retrieve an "associated remedial solution" and then providing that solution to an optimizer (e.g., Côté's layout optimizer 520). Pet. 68 (quoting Ex. 1006, 11:55–12:3) (citing Ex. 1006, 9:1–17, 10:46–58). According to RPX, Kroyan's "associated remedial solutions" amount to the "local process modifications," as recited in independent claim 1. *Id.* (citing Ex. 1002 ¶¶ 300–303). RPX argues that the combination of Côté, Bamji, and Kroyan teaches searching a "look-up table" because Kroyan's knowledge database may be used to compute the claimed "local process modifications." *Id.* (Ex. 1002 ¶ 304).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté, Bamji, and Kroyan account for the limitation of dependent claim 9. *See generally* PO Resp. 64–65. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté, Bamji, and Kroyan account for this limitation, and we agree with and adopt RPX's analysis. *See* Pet. 68. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 9 would have been obvious over the combined teachings of Côté, Bamji, and Kroyan.

E. Obviousness Over the Combined Teachings of Côté, Bamji, and Cobb

RPX contends that claim 12 of the '012 patent is unpatentable under § 103(a) over the combined teachings of Côté, Bamji, and Cobb. Pet. 69–72. In support of its contentions, RPX explains how this proffered combination teaches or suggests the subject matter of the challenged claim, and provides reasoning as to why one of ordinary skill in the art would have been prompted to modify the teachings of these references. *Id.* RPX also relies on the Declaration of Dr. Nagel to support its positions. Ex. 1002 ¶¶ 305–311. By virtue of its dependency, IYM contends that claim 12 includes all the limitations of independent claim 1 and, therefore, this claim is patentable over the combined teachings of Côté, Bamji and Cobb for the same reasons discussed above with respect to the grounds based on obviousness over the teachings of Côté alone and the combined teachings of Côté and Bamji. PO Resp. 64–65.

We begin our analysis with a brief overview of Cobb, and then we address RPX's contentions with respect to the claims at issue in this asserted ground.

1. Cobb Overview

Cobb generally relates to IC design and, in particular, to designing deep submicron ICs. Ex. 1007, 1:8–10. As background, Cobb discloses that optical proximity correction ("OPC") refers to modifying IC designs "to compensate for manufacturing distortions due to the relative proximity of edges in the design." *Id.* at 2:12–16. OPC also accounts for manufacturing distortions "introduced during chemical processing, such as resist etching and oxide etchings." *Id.* at 2:16–20. Cobb discloses two types of OPC:

(1) model-based OPC; and (2) rule-based OPC. *Id.* at 2:28–29, 2:43–44. Model-based OPC predicts manufacturing distortions in a design layout and compensates for them at the design stage by operating on edge fragments. *Id*. at 2:29–32. Cobb, however, discloses that "[m]odel-based OPC can be very computationally intensive." *Id.* at 2:34. Rule-based OPC introduces a pre-determined alteration when a particular feature is encountered in a design layout. *Id.* at 2:44–46. Cobb, however, discloses that "[r]ule-based OPC . . . relies on the presumption that altering a particular feature with a predetermined change will improve the quality of the manufacturing design. [This] presumption does not always hold true." *Id.* at 2:50–53. According to Cobb, it would be desirable if both model-based OPC and rule-based OPC "could be selectively employed at a feature level in an efficient manner." *Id.* at 3:16–18.

Cobb seeks to achieve this objective by providing a method and apparatus for designing IC layouts composed of edge fragments by identifying and tagging certain properties of each edge fragment. Ex. 1007, 4:30–34. After an edge fragment has been identified and tagged, it can be controlled in various ways. *Id.* at 4:35–38. For instance, "a user can apply different types of . . . [OPC] to the tagged edge fragments, or view which edges in an IC layout have received certain tags." *Id.* at 4:38–42. Cobb discloses that its method and apparatus for designing IC layouts "may achieve performance advantages, for instance, by selectively applying OPC to only tagged edge fragments, resulting in a potentially significant time savings." *Id.* at 4:48–51.

2. Claim 12

Claim 12 depends from independent claim 1, and recites "tagging locations on a layer where enforcing said new local constraint distances are unsuccessful, and performing optimal process correction only on said tagged locations, whereby the processing time and data size of the mask layout is reduced." Ex. 1001, 9:11–15.

In its Petition, RPX contends that Cobb teaches this limitation because it discloses an approach for "selectively applying OPC to only tagged edge fragments, resulting in a potentially significant time savings." Pet. 71 (quoting Ex. 1007, 4:48–51). RPX argues that Cobb discloses identifying and tagging edge fragments of IC layouts that have specific properties indicative of "edge placement distortion due to the proximity of neighboring features." *Id.* (quoting Ex. 1007, 3:25–31) (citing Ex. 1007, 4:30–41). According to RPX, the combination of Côté, Bamji, and Cobb would include a step of performing OPC, as taught by Côté, and that OPC would be capable of using Cobb's selective tagging technique. *Id.* at 71–72. Stated differently, RPX asserts that, when Cobb's selective tagging technique is applied to the combination of Côté, Bamji, and Cobb in a manner that follows the optimization performed by Côté and Bamji, the edge fragments tagged would be those for which the enforcement of new local constraint distances were unsuccessful. *Id.* at 72 (citing Ex. 1002 ¶¶ 309–311).

Turning to the rationale to combine the teachings of Côté, Bamji, and Cobb, RPX contends that a person of ordinary skill in the art would have been motivated to combine the teachings of Côté and Bamji with those of Cobb because Côté discloses analyzing and adjusting a design layout using OPC to yield a new design layout. Pet. 70 (citing Ex. 1004, 3:16–22, 6:25–

28, 7:43–48). RPX argues that Cobb discloses achieving substantial performance advantages by identifying specific edge fragments at risk of manufacturing distortion and "selectively applying OPC to only tagged edge fragments." *Id.* (quoting Ex. 1007, 4:43–51). According to RPX, a person of ordinary skill in the art would have appreciated the advantages of implementing Côté's OPC using Cobb's selectively tagging technique in order to gain the performance advantages or efficiencies taught by Cobb. *Id.* (citing Ex. 1004, 6:18–27; Ex. 1007, 4:51–65; Ex. 1002 ¶¶ 306, 307).

In its Patent Owner Response, IYM does not address separately whether the combined teachings of Côté, Bamji, and Cobb account for the limitation of dependent claim 12. *See generally* PO Resp. 64–65. We have reviewed RPX's explanations and supporting evidence as to how the combined teachings of Côté, Bamji, and Cobb account for this limitation, as well as RPX's reasoning as to why one of ordinary skill in the art would have been prompted to modify their respective teachings, and we agree with and adopt RPX's analysis. *See* Pet. 70–72. Accordingly, RPX has demonstrated by a preponderance of the evidence that the subject matter of dependent claim 12 would have been obvious over the combined teachings of Côté, Bamji, and Cobb.

F. Constitutional Challenge

IYM contends that the Supreme Court's decision in *Oil States Energy Services LLC v. Greene's Energy Group, LLC*, 138 S. Ct. 1365 (2018) was limited to addressing *Oil States's* constitutional challenge that subjecting its patent to an *inter partes* review proceeding violates its right to a jury trial under the Seventh Amendment of the U.S. Constitution. PO Resp. 65. IYM noted that that Supreme Court emphasized that its *Oil States* decision

"should not be misconstrued as suggesting that patents are not property for purposes of the Due Process Clause or the Takings Clause." *Id.* (quoting *Oil States*, 138 S. Ct. at 1379).

IYM contends that our exercise of jurisdiction to adjudicate the patentability of the '012 patent would violate its rights under the Takings Clause of the Fifth Amendment of the U.S. Constitution because this patent issued in November 2008, which was several years prior to the enactment of the America Invents Act ("AIA"). PO Resp. 65. According to IYM, the retroactive nature of this *inter partes* review proceeding underscores the unconstitutionality of the entire process. *Id.* IYM also argues that subjecting the '012 patent to an *inter partes* review proceeding "places a severe, disproportionate, and extremely retroactive burden on" IYM. *Id.* at 66 (quoting *E. Enters. v. Apfel*, 524 U.S. 498, 538 (1998)).

In its Reply, RPX contends that IYM does not offer any substantive analysis to support its argument that subjecting the '012 patent to an *inter partes* review proceeding violates IYM's rights under the Takings Clause. Pet. Reply 26. RPX further contends that IYM does not cite to any authority that would authorize the Board to determine that the "retroactive" application of the AIA is unconstitutional. *Id.*

We decline to consider IYM's constitutional challenge because "administrative agencies [generally] do not have jurisdiction to decide the constitutionality of congressional enactments." *Riggin v. Office of Senate Fair Emp't Practices*, 61 F.3d 1563, 1569 (Fed. Cir. 1995); *see also Harjo v. Pro-Football, Inc.*, 50 USPQ2d 1705, 1710 (TTAB 1999) ("[T]he Board has no authority . . . to declare provisions of the Trademark Act unconstitutional."), *rev'd on other grounds*, 284 F. Supp. 2d 96 (D.D.C.

2003). *But see Am. Express Co. v. Lunenfeld*, Case CBM2014-00050, slip op. at 9–10 (PTAB May 22, 2015) (Paper 51) ("[F]or the reasons articulated in *Patlex* [*Corp. v. Mossinghoff*, 758 F.2d 594 (Fed. Cir. 1985)], we conclude that covered business method patent reviews, like reexamination proceedings, comply with the Seventh Amendment.").

III. CONCLUSIONS

RPX has demonstrated by a preponderance of the evidence that (1) claims 1–3, 5, 13, and 14 are unpatentable under § 103(a) over the teachings of Côté; (2) claims 1–3, 5, 10, 11, and 13 are unpatentable under § 103(a) over the combined teachings of Côté and Bamji; and (3) claims 3, 4, and 6–9 are unpatentable under § 103(a) over the combined teachings of Côté, Bamji, and Kroyan; and (4) claim 12 is unpatentable under § 103(a) over the combined teachings of Côté, Bamji, and Cobb.

IV. ORDER

In consideration of the foregoing, it is

ORDERED that claims 1–14 of the '012 patent are held to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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