IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

IYM TECHNOLOGIES LLC Plaintiff, v. ADVANCED MICRO DEVICES, INC. Defendant.	)	C.A. No. 16-cv-649-GMS

ORDER CONSTRUING THE TERMS OF U.S. PATENT NO. 7,448,012

After considering the submissions of the parties and hearing oral argument on the matter, IT IS HEREBY ORDERED, ADJUDGED, and DECREED that, as used in the asserted claims of U.S. Patent No. 7,448,012 ("the '012 patent"):

1. The phrase **"constructing a system of initial constraints among said layout objects,"** as used in the '012 patent, is construed to mean "building a set of linear equations from the initial coordinate variables of the layout objects and the initial limitations on the geometry parameters of the layout objects."[1]

[1] Plaintiff's argument is twofold: the term "constraints" needs no construction, but, if it does, the term means "limits on geometry parameters of the layout objects in the design layout." Defendant argues that the entire claim phrase requires construction and means "building a set of linear equations from the coordinate variables of the layout objects and constraint distances between layout objects." The court finds that both the term "constraints" and the entire claim phrase requires construction.

First, the term constraints should be construed to mean "limitations on the geometry parameters of the layout objects in the design layout." The Summary of the Invention describes the process of the layout production and design. When the initial layout is produced by the software, "the relative distance between layout objects are constrained by design rules." '012 patent col. 1, ll. 21–23. The chip layout remains true to the design rules despite any modifications to the layout done by the present invention. *Markman* Hr'g Tr. 49:12–17. The design rules, therefore, act as the very first constraints among the layout objects. The specification explains that "design rules guarantee yield by limiting layout geometry parameters such as minimum spacing, minimal line width, etc." '012 patent, col. 3, ll. 10–11; *see*

also Markman Hr'g Tr. 6:6–9. The court is satisfied that constraints, like design rules, are "limits on the geometry parameters of the layout objects in the design layout."

Plaintiff offered the court a definition of constraints, which the court accepted, but has failed to establish what "*constructing* a system of initial constraints" means. Defendant argues that the construction of a system of initial constraints requires three things: (1) linear equations, (2) constraint distances, and (3) coordinate variables. The court agrees that both linear equations and coordinate variables should be included in the construction of this claim phrase, but the court will not include constraint distances in its construction.

The specification and prosecution history support Defendant's argument that linear equations are a required component in the construction of a system of initial constraints. Defendant asks the court to limit the inventor's claimed "system of constraints" to linear equations. Plaintiff disagrees and argues that "constraints and equations are different concepts," because the intrinsic evidence shows that equations can be described as something other than a constraint and a constraint does not need to be represented in an equation. *Markman* Hr'g Tr. 19:5–6, (D.I. 71 at 7.) Defendant argues that the specification, prosecution history, and the nature of the invention all demonstrate that constructing a system of initial constraints requires building linear equations. (D.I. 74 at 10.) The court agrees.

First, Plaintiff was unable to point to one place in the specification or embodiments that teach nonlinear equations. Instead, Plaintiff points to the prosecution history. The inventor amended claim 1 to overcome a 35 U.S.C. § 102 rejection by deleting the word linear. (2008 Amendment, at J.A. 254.) In explaining the amendment, the inventor cited the Heng and the Marple patents to support his conclusion that "non-linear constraints are implied in the present invention." (2008 Amendment, at J.A. 258), (D.I. 75 at 2.) The Heng specification teaches that "[t]he system of linear constraints is difficult to solve with a non-linear objective function." (Heng patent, at J.A. 540.) Plaintiff believes that although nonlinear constraints are more difficult to enforce, "anyone who talks about any constraints or any system of constraints know they exist." *Markman* Hr'g Tr. 45:15–16. The Marple patent comes to a similar conclusion. The Marple patent represents constraints both linearly and nonlinearly and teaches that "[s]ince nonlinear constraints are more difficult to enforce in mathematical programming, a linear approximation to [the] constraint is used instead." (Marple et. *al*, at J.A. 409), *Markman* Hr'n Tr. 42:22–43:2. Defendant contends that Marple "is still teaching us that in your system of initial constraints you are using linear equations." *Markman* Hr'g Tr. 46:20-23. The court agrees with Defendant. The inventor's amendment does not indicate that a person having ordinary skill in the art would have used nonlinear constraint equations. In fact, Marple teaches that when faced with a nonlinear constraint equation, the best way to enforce the constraint is to convert the equation from nonlinear to linear.

The specification further shows that the inventor intended that this claimed step be completed using linear equations. The sole description of the sole embodiment of this claimed step, figure 1, Block 002 points to a "well-known" procedure can be found on page 863 of the article "Algorithmic Aspects of One-Dimensional Layout Compaction" by Jurgen Doenhardt and Thomas Lengauer ("the Doenhardt article"). '012 patent, col. 3, ll. 19–23. The article's only representation of constraints is in the form of linear equations and "are generated between the x-coordinates of the layout components." (Doenhardt article, at J.A. 661.) The linear constraint equations form three classes of constraints: (1) constraints that encode contacting rules, (2) constraints that encode design rules, and (3) constraints that encode minimum distance. (Doenhardt article, at J.A. 661-662.) Therefore, even though *Philips* instructs against claim constructions that limit the claimed invention to the specification or to one embodiment, here, the use of linear equations to construct a system of constraints as shown in figure 1, Block 002 and its description in the specification, the Doenhardt article, the Heng and Marple patents all exclusively use linear equations. The court finds that a person of ordinary skill in the art would rely on this evidence to achieve the objects of the '012 patent. *See Medicines Company v. Mylan, Inc.,* 853 F.3d 1296, 1309 (Fed. Cir. 2017) (limiting a claim term to an example in a patent that was the only embodiment of the term and the only description that cast light on what the term meant to a person of ordinary skill in the art). The court, therefore, limits this claimed step to linear equations.

Next, Defendant argues—and the court agrees—that coordinate variables are a necessary component of the linear equations used in the "constructing a system of initial constraints" step. The court finds that the claim language, the nature of the invention, and the specification support the inclusion of the phrase "coordinate variables" in the claim's construction.

Defendant points to the term "coordinate variables," which appears for the first time in the "updating *the* coordinate variables. . . ." step of the claim, thus, the "the" indicates that coordinate variables must have existed in the system of initial constraints before the "updating" step. *Markman* Hr'g Tr. 37:15–18; 37:24–38:5 (emphasis added). Further, Defendant argues that the inventor used the word "updating" in the last step of the claim to indicate that the coordinate variables were present in the system of initial constraints and that the system must be updated to create the final layout design. *Markman* Hr'g Tr. 37:7–15.

2. The phrase "**computing local process modifications to change said initial constraints using said descriptions of manufacturing process,**" as used in the '012 patent, is construed to mean "computing location specific modifications to the system of initial constraints using said descriptions of the manufacturing process."[2]

Plaintiff argues that the claim language suggests that "coordinate variables'" antecedent basis is in the first step of the claim, not of the "constructing a system of initial constraints" step not at issue here. *Markman* Hr'g Tr. 44:6–8.

Defendant argues—and the court agrees—that coordinate variables are inherent to constraint equations because they are merely position variables. *Markman* Hr'g Tr. 30:1, 37:3–5. These variables exist from the moment that the layout objects are initially placed in the chip design and remain throughout the modification process. The claim language indicates that the "constructing a system of initial constraints" step requires the incorporation of the two steps that precede it: "receiving a design layout comprising a plurality of layout objects residing on a plurality of layers" and "receiving descriptions of manufacturing process." '012 patent, col. 8, ll. 18–20. Therefore, the inclusion of coordinate variables in the "constructing a system of initial constraints" is a means of marking where a layout object is placed based on the initial layout created by the layout software implementing the design rules, and not a method of constraining the layout objects. The court does not find that the inclusion of the term "coordinate variables" limits the claim because coordinate variables are necessary to the construction of a system of initial constraints.

Finally, Defendant argues that distance values are a necessary component of the construction of a system of initial constraints. The court disagrees. The previously cited Doenhardt article states that the linear constraint equations used for this step in the claim form three classes of constraints—one of which encodes minimum distance. (Doenhardt article, at J.A. 662). Further, neither the specification nor the claim language use the term distance values or teach that this claim phrase should be limited to the construction of linear equations from coordinate variables and distance values. Therefore, the court excludes the term "distance values" from its claim construction.

[2] Defendant proposes that this claim phrase means "computing location-specific distance values to change the constraint distance in the system of initial constraints based on manufacturing response variables." Plaintiff contends that "local process modifications" means "location specific modifications to the system of initial constraints to account for local processing conditions." The critical difference between the two parties is the construction of "local process modifications." That is where the court will place its focus.

Defendant argues that "local process modifications" must be a distance value because only like elements can be added. (D.I. 70 at 12.) Defendant's argument assumes that the court will adopt its construction of the next step of the claim, that since "local process modifications" are combined with "the constraint distances in said system of initial constraints," resulting in a new local constraint distance, the combined values must both be distance values. (D.I. 74 at 13); '012 patent, col. 8, ll. 27-19, *Markman* Hr'g Tr. 54:9–16. The court disagrees. While the next step of the claim indicates that the local process modification is combined with the initial constraint distances to result in a new constraint distance, '012 patent, col. 8, 27–29, that alone does not support limiting "local process modifications" to "location-specific distance values." Nothing in the patent suggests that two values must be the same to be combined. Further, the '012 patent and prosecution history are replete with uses of the term "distance," suggesting that if the inventor thought that the term "distance values" more adequately conveyed the scope of his invention, he could have included the phrase in this step of the claim.

Plaintiff also argues—and the court agrees—that Defendant's construction changes the nature of the claim. The '012 patent solves the problem of processing hotspots, which are localized areas of a chip where combinations of geometric features can cause chip failure. (D.I. 71 at 9), *Markman* Hr'g 7:1–4. To address this problem, the inventor developed a method for adjusting the initial layout constraints to account for these localized issues while maintaining design rule correctness and design rule intent. *Id.*, *see also Markman* Hr'g Tr. 10:4–8. Thus, the purpose of this invention was to allow the inventor to make location specific modifications to the system of initial constraints. Defendant's construction seeks to eliminate that purpose altogether. The court sees no reason, either in the claim language or specification, to so limit the claim. Instead, the court construes the term to mean "location specific modifications to the system of initial constraints." (D.I. 71 at 8.)

3. The phrase **"constructing new local constraint distances by combining said local process modifications with constraint distances,"** as used in the '012 patent, is construed to have its plain and ordinary meaning.[3]

4. The phrase **"enforcing said new local constraint distances,"** as used in the '012 patent, is construed to mean "solving a set of equations after incorporating the new local constraint distances."[4]

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[3] Defendant asks the court to construe the term "combining" to mean "adding." Plaintiff argues that no construction is necessary. The court agrees.

Defendant argues that only like terms can be added together and, because of that, "combining" the local process modifications with the initial constraint distances to produce "new local constraint distances" requires that terms being combined must be distance values. (D.I. 70 at 12.) The court, again, rejects Defendant's argument. Defendant further attempts to parse words from the specification. For example, Defendant cites to the use of the word "plus" in the Summary of the Invention: "The original design rule distance *plus* local process modification effectively creates a new constraint for every unique situation." '012 patent, col. 1, ll. 64–64 (emphasis added). Defendant also cites the description of the embodiment that illustrates this step of the claim: "Local constraint distance is a *general addition* to the constraint distance specified by the design rules." '012 patent, col. 3, ll. 60–61 (emphasis added). The court finds Defendant's citations to synonyms of "add" in the specification unconvincing. The portions of the specification Defendant cites describe one action that takes place during the "combining" step, but fails to account for other mathematical possibilities of combining local process modifications with the initial constraints, such as the use of multipliers or percentages. *Markman* Hr'g Tr. 55:9–14. However, the step encompasses more than the addition of constraint distances. The specification clearly explains that "Block 006 *combines* local process modification value delta_dij, with the original constraint distances generated in block 002." '012 patent, col. 3, 53–59 (emphasis added). Defendant's construction would read out the inventor's embodiment and description. Therefore, because the court finds no clear intention to limit the claim scope in the intrinsic record, it concludes the term "combining" needs no construction.

[4] Defendant argues that "enforcing" should be construed as "solving the set of linear equations after incorporating the new local constraint distances." Plaintiff contends that no construction is necessary. Plaintiff argues that the enforcement step does not require solving because "[e]nforcing means finding adjustments of the layout that will remove or fix violations, in the case of the new local constraint distances." *Markman* Hr'g Tr. 75:6–7, 11:1–3. The court finds this explanation puzzling in light of the language of the claim, Plaintiff's statements during the *Markman* hearing, and the specification. The court construes the term to mean, "solving a set of equations after incorporating the new local constraint distances."

The claim language of the next step of claim 1 indicates that solutions are used to update "the coordinate variables of layout objects according to the solutions obtained from enforcing said new local constraint distances." '012 patent, col. 8, ll. 31–33, *Markman* Hr'g Tr. 72:23–25. Further, during the *Markman* hearing, Plaintiff was unable to explain this claimed step to the court without indicating that the "enforcing step is going to result in solutions." *Markman* Hr'g Tr. 66:24–25, 67:24–68:10, 69:17–18.

Further, the specification supports Defendant's construction. Figure 1 "shows a block and flow diagram for the present invention." '012 patent, col. 3, ll. 4–5. The figure includes Block 008, labeled "Enforce New Constraints." *Id.* The preferred embodiment of Block 008 is illustrated in figure 2. *Id.* Figure 2 is a block and flow diagram that includes Block 102 labeled "Solve linear system." '012 patent, fig. 2. The embodiment illustrates a three step process that starts with a system of equations for the local constraint. '012 patent, col. 4, ll. 18-19. The illustration is described as follows: First an objective function Ct*X is constructed, Ct represents a row vector of coefficients for achieving various optimization objectives and X represents the position variable in the layout. '012 patent, col. 4, ll. 22–25. The objective function is constructed for "wire length minimization, legalization, compaction, and other measurable

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metrics of layout." '012 patent, col 4, ll. 32–34. Second, the equation is solved. '012 patent, col. 4, l. 35. Finally, the layout is updated with the solution from step three using two methods: either horizontally and vertically at the same time or using the heuristic process to remove errors one at a time. '012 patent, col. 4, ll. 40–41, 48–49.

The embodiment's description of the method described in the "enforcing" step, in addition to the claim language and Plaintiff's *Markman* hearing statements, supports Defendant's argument that the "enforcing" step requires finding a series of solutions that are used to update the layout objects in the next step.