Claims:

1. Method for the lightweighting and/or designing of an additively manufactured article, whereby the article comprises one or more integral article parts each with **a structure**, in particular each or some of the one or more integral article parts with **an internal structure**,

   the method comprising the step(s) of:

   infilling and/or building each of the one or more integral article parts with **a quasi-crystalline structure**, whereby the quasi-crystalline structure is a three-dimensional quasicrystal made from two or more **types** of **cells in the shape of rhomboids,**

   wherein the method further comprises the step of: bisecting the cell(s) in the shape of a rhomboid such, that the faces resulting from the bisection have hexagonal form, thereby creating two equal monotriatruncated tetrahedra out of each cell.

2. Method according to any one of claim 1, whereby the infilling and/or building each of the one or more integral article parts is an infilling and/or building with a **quasiperiodic or aperiodic minimal surface infill** and/or **quasiperiodic minimal or aperiodic surface design structure**, in particular whereby the method comprises the further step of using the quasi-crystalline structure as **framework** to generate a quasiperiodic or aperiodic minimal surface infill and/or quasiperiodic or aperiodic minimal surface design structure.

3. Method according to any one of claims 1 or 2, whereby the method further comprises the step of **creating a geometry of a quasicrystal**, in particular by performing the steps of:

   a. inputting at least four primary vectors;

   b. creating a number of groups of parallel planes equal to the number of primary vectors inputted in step a., whereby each group of parallel planes comprises at least three parallel planes.

4. Method according to claim 3, whereby the planes in one specific group of parallel planes are evenly spaced, in particular all the planes of the one specific group.

5. Method according to claim 3, whereby the planes in one specific group of parallel planes are randomly spaced, in particular all the planes of the one specific group.

6. Method according to claim 3, whereby the planes in one specific group of parallel planes are spaced according to a predetermined **pattern**, in particular all the planes of the one specific group.

7. Method according to any one of claims 3 to 6, whereby cat least some of the planes in one specific group of parallel planes are evenly spaced and/or some of the planes randomly spaced and/or some of the planes spaced according to a predetermined pattern.

8. Method according to one of the preceding claims, further comprising the step of assigning each monotriatruncated tetrahedron to one of two groups A or B, such that **two labyrinths** A, B are formed.

9. Method according to any one of claims 1 to 8, further comprising the step of inserting skeleton graph(s) into each of the types of cells in the shape of a rhomboid.

10. Method according to claim 9, wherein one skeleton graph A', B' is inserted into each monotriatruncated tetrahedron such that two interleaved skeleton graphs A', B' are created spanning the entire quasicrystal without interconnecting at any point.

11. Method according to claim 10, whereby the skeleton graphs A', B' each extend through one of the two labyrinths A, B, in particular whereby each skeleton graph A', B' extends through one group of monotriatruncated tetrahedra.

12. Method according to any one of claims 3 to 11, further comprising selecting the number of planes in each group of planes as measure of resolution for the desired internal structure.

13. Method according to claim 12, whereby the selecting is performed individually for any part of the one or more integral article parts with an internal structure.

14. Method according to any one of claims 10 to 13, further comprising scaling down skeleton graphs A', B' outside of the one or more integral article parts each with an internal structure to *create* densified skeleton graphs A'', B'', in particular to create locally densified skeleton graphs A'', B''.

15. Method according to any one of claims 1 to 14, where the quasi-crystalline structure is used to define a quasiperiodic minimal surface, in particular skeleton graphs A', B'; A'', B'' are used to specify the minimal surface.

16. Method according to any one of claims 1 to 14, where the quasi-crystalline structure is used to define an aperiodic minimal surface, in particular skeleton graphs A''', B'''; are used to specify the adapted minimal surface after segments have been removed according to load case analysis and/or article shape analysis.

17. Method for the lightweighting and/or designing of an additively manufactured article according to any one of claims 1 to 16, whereby the article comprises one or more integral article parts each with a structure, in particular each or some of the one or more integral article parts with an internal structure, the method comprising the steps of:

    a. providing two skeleton graphs A', B', in particular two skeleton graphs A', B' extending through one group of monotriatruncated tetrahedra each, such that two interleaved skeletal skeleton graphs A', B' are created spanning the entire quasicrystal without interconnecting at any point;

    b. removing units and/or segments from the skeleton graphs A', B' depending on local stress/strain analysis.

18. Computer program product for preprocessing of an additively manufactured article comprising one or more article parts, each with a structure, in particular an internal structure, the computer program product being adapted at executing a method according to any one of claims 1 to 17 when executed on a computer.

19. Additively manufactured article obtainable by performing a method according to any one of claims 1 to 16, the article comprising a quasi-crystalline structure and/or a **quasiperiodic minimal surface infill** and/or **quasiperiodic minimal surface**

design structure and/or an aperiodic minimal surface infill and/or an aperiodic minimal surface design structure.

20. Article according to claim 19, wherein the article comprises an outer skin and an infill and wherein an essentially zero-mean-curvature surface, preferably minimal surface, infill touches the outer skin in an essentially perpendicular angle.

21. Article according to any one of claims 19 or 20, wherein the article comprises low-density area(s) O, O''' and/or high-density area(s) P'''.

22. Use of a pair of skeleton graphs (A', B') obtainable by a method according to any one of claims 1 to 17, for a preprocessing step of an additive manufacturing job, whereby a pair of skeleton graphs A', B' is superimposed with a model of an article and the skeleton graphs A', B' are scaled hyperbolically such as to create a template for a minimal surface infill of the said article based on surfaces that are minimal and equidistant between the two pairs of skeleton graphs A', B'.

23. Use of a of a pair of skeleton graphs (A', B') obtainable by a method according to any one of claims 1 to 17, for a preprocessing step of an additive manufacturing job, whereby a pair of skeleton graphs A', B' is superimposed with a model of an article and segments of the skeleton graphs A', B' are removed depending on an article shape analysis and/or load case analysis resulting in adapted skeleton graphs A''', B'''.

24. Use according to claim 22, wherein the pair of skeleton graphs A', B' is provided with a high-density P''' corresponding to the highest density required by any area and/or geometry of the article.