

## **Activation function as an inspiration for metamaterial design and gyroid as inspiration for activation function design. Part 2: next contexts**

Roman Budjač<sup>1,2</sup>, Iveta Markechová<sup>1</sup>, and Hana Stúpalová<sup>1</sup>

<sup>1</sup>*Slovak University of Technology, Faculty of Materials Science and Technology,  
Jána Bottu 2781/25, 917 24 Trnava, Slovakia*

<sup>2</sup>*University of Žilina, Research centre, Univerzitná 8215/1, 010 26 Žilina, Slovakia*

Metamaterials represent a relatively new field of research. Our previous approach to their design was to create a translational surface from some type of mathematical curve. Elliptical curve and sigmoid have dominated. Mostly by linear transformations of the translational surface as such, and also by replicating it or by transformed replication we created different structures of metamaterials. In the current work, we were partly inspired by the work of researchers from MIT and their original approach in creating the so-called procedural metamaterials.

Continuation of our investigation of planar cutting curves on the gyroid showed surprising possible connections of their shape, under specific input conditions, with phonon modes for periodic structures with glide symmetry. Here we finger them out.

Research work with the sigmoid and gyroid bring us several inspirations, for example for the field of applications in biomedicine, in student education and in educational work for lay people. Please, familiarize yourself with them via this output of our research work.

*This contribution was funded by the institutional project 1625 09/2020-07/2022 "Simulation of 3D functional nanomaterial structures in the style of origami and kirigami" and by the KEGA project 004STU-4/2022 "Model of online teaching with an emphasis on increasing the quality of education of engineers in a period of a possible pandemic". The publication is partially the result of the project 7095 04/2021-06/2023 implementation: „Strategic research in the field of SMART monitoring, treatment and preventive protection against coronavirus (SARS-CoV-2)“, supported by the Operational Programme Integrated Infrastructure funded by the European Regional Development Fund.*