

## A New Concept of n-Dimensional Machine Design

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**Abstract.** Every industrial product should be adapted and harmonized with existing or potential needs in various areas of human activity. Basic sciences are followed by technical sciences, which lead to product development, including engineering design and related activities. After completing the engineering design, the product is manufactured using appropriate production technologies. Art, particularly through industrial design, is more or less included in product development, depending on the type of product. Last, but not least, the state and dynamics of product development are influenced by the social and economic situation, as well as politics, which create an environment for all these activities [1]. Otherwise, realized products significantly impact each of these areas of society and civilization development. A product life-cycle includes the following main stages [1]: 1) Problem/Need/Market and Company Goals/Potential; 2) Product planning; 3) Design/ Development; 4) Parts production/Assembly/Testing; 5) Marketing/Sale; 6) Use/Maintenance and 7) Energy recovery/Recycling/Disposal. The main steps of product design and development are: 1) Task setting; 2) Concept design/Synthesis; 3) Selection of shapes, dimensions and materials; 4) Analysis/Simulation/ Optimisation; 5) Corrections/Modifications and 6) Detailed drawings. In the Architecture, Engineering, and Construction (AEC) industry, there is a concept known as Building Information Modelling (BIM), which has undergone significant development over the past fifteen years. It represents a modern approach to the design, documentation, delivery, and lifecycle management of buildings by utilizing project databases in conjunction with object-based parametric modelling [2]. The primary aim of this work is to propose a comprehensive methodology for Machine Information Modelling (MIM) to the scientific community in the field of machine design. It also seeks to initiate the development of a complex methodology tailored to all aspects of machine design while incorporating valuable elements from BIM. Some certain aspects similar to BIM principles are already present in machine design and manufacturing, though they have not been systematized and standardized or unified, as they have in the AEC sector. Our current main focus is on a multidimensional (nD) modelling approach to MIM. It is necessary to create a very complex information system that would contain all the mentioned dimensions (or new ones that will inevitably emerge with industrial development) and provide instructions for their incorporation into the machine design. This is impossible without the application of modern information and communication technologies (ICT), the utilization of powerful digital resources, and the integration of artificial intelligence. Additionally, it is essential to include the process of standardization and the publication of appropriate standards for the realization of n-dimensional design, similar to those for BIM, as well as using the unique aspects of machine design, which lead to original MIM. The number of dimensions is theoretically infinite. The greater the amount of information we incorporate into a model, the more dimensions we can generate!

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