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EDITORIAL

Performance Based Design

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Performance in design processes depends on different factors and the meaning of performance is varied in different fields. In order to define a general definition of performance for its further analysis in all disciplines, we represent the performance of an individual or a group as a function of workload and mental stress. According to the mental stress model (Nguyen & Zeng, 2012), a moderate range of stresses for individuals may lead to their best performance, which is achieved when their workload and mental capability are at a comparable level. In the meantime, human mental capacity can be defined as individuals' knowledge, skills, and affective. In this special issue, four papers are selected to address different aspects of designer's mental capability. The first paper attempts to achieve better product performance by updating the design and analysis tools and skills. In the second paper, methods were developed to analyse and optimize a sample bicrystal structure by checking its performance when it is subjected to different loads and affected by different shapes of the structure. The third paper illustrates a software engineering viewpoint about developing performance, which defines software designing performance in terms of time and cost. The last paper represents performance indicators and objectives as the main factors of architecture design, which further analyses these factors and designers' available tools and skills through a detailed literature review.

The first paper, by Zuo, Wang and Liao, titled "An Optimal Design Method for Energy-Saving Structure Based on Genetic Algorithm and Finite Element Analysis", proposed a design methodology to improve performance of vulcanizing forming moulds through optimizing their temperature field. Vulcanizing forming mould affects the quality of compound rubber bearings, which is widely utilized in different industries. They tried to optimize the structure and power distribution of moulds. They first obtained effective parameters, afterward they optimized energy consumption based on the extracted parameters and finally they checked the results through simulating problem with Finite Element Method (FEM). They extracted design parameters from the superposition principle of linear and steady-state heat transfer. Heating power of pipes and their location were considered as the designing parameters and they minimized temperature differences on the inner wall of the mould by utilizing Genetic Algorithm (GA). Through utilizing FEM, they demonstrated the impact of optimization on temperature field and they showed that the maximum temperatures and maximum heat fluxes were increased in all the optimization scenarios and they concluded that the performance of design solutions in terms of energy-saving was increased.

The second paper, authored by Xing, Yan, Jiang, and Qin, titled "Effect of Inclination Angle on Mechanical Behaviour and Deformation Asymmetry in Aluminium Bicrystal", discussed the impact of inclination angle on the mechanical performance of a bicrystal through analysing the problem with the

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function-behaviour-structure model. They considered aluminium bicrystal as the structure and the combination of its strength and ductility as the function of design. Moreover, they presented yield stress and strain, peak stresses, plastic flow stresses, count on HCP atoms, and dislocation activities as the behaviours of a design solution. Finally, they considered the angle of Grain Boundary (GB) and loading direction (compression or tension) as the environment factors of a design problem. They tested five different GBs subjected to tension and compression and reported different behaviours of bicrystal. They identified different plasticity and elasticity mechanisms for aluminum bicrystal during tension and compression. They also concluded that the rotation of GB plane undermines both elasticity and plasticity of the bicrystal interfaces because yield stress gradually decreases with the increasing of inclination angle.

The third paper, by Kaya, Cetinkaya and Dogru and titled "Off-the-Shelf Connectors for Interdisciplinary Components", represented a methodology to reuse connectors in Component-Oriented Software Engineering modelling as an alternative to writing code for integration. Considering that supplying software on time within expected quality is an issue for developers, they tried to increase the performance of software development through reducing code writing. They considered compositional models and proposed adaptable connectors for considering variability and diversity of problems. In their model, problem decomposition is performed until the matching between components and decomposition level can be achieved. In order to illustrate the effectiveness of their model, they conducted a case study of e-commerce system and they presented connectors, which can be utilized and customized for different applications to reduce the cost of system development.

The last paper, by Zhao and Angelis, entitled "Performance-based Generative Architecture Design: A Review on Design Problem Formulation and Software Utilization", tried to analyse and classify all the relevant research and tools, which are respectively conducted in Performance-based Generative Architecture Design (PGAD) field and utilized for PGAD. In this paper, authors presented all correlations in formulating a PGAD and compared PGAD implementation tools. They represented the importance of PGAD by analysing the growing volume of literature in the aforementioned area. Afterward, they proposed that for formulating a design problem, we need to realize building components, decision variables, performance indicators, performance objectives and correlation among these items. They analysed all their references in terms of their capability for extracting correlation among building components, performance objectives, decision variables, and performance indicators. Finally, they discussed four stages of parametric modelling, simulation, optimization, and post processing for Multi-Objective Optimization (MOO) and they introduced four Integrated Design Environments (IDE), which are capable of MOO in architecture.

References

Nguyen, T. A., & Zeng, Y. (2012). A Theoretical Model of Design Creativity: Nonlinear Design Dynamics and Mental Stress-Creativity Relation. *Journal of Integrated Design and Process Science*, *16*(3), 65–88.

Author Biographies

Seyed Reza Razavi is a M.Sc. graduated in the Concordia Institute for Information Systems Engineering at Concordia University, Montreal, Canada. He received his BEng and his first MSc in Aerospace Engineering and his research interests include design methodology, complex product development in aerospace industry and project management.

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