Evaluation of the Complexity of Generic Models in System Configuration

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Abstract

In the context of Industry 4.0, companies must offer the market personalized systems (from goods to services). This customization is mainly supported by specific tools, called Configurators, which are based on a generic model formalizing the catalog and diversity proposed by a company, on a family of systems. The generic model or GM formalizes all the items (systems, subsystems, components, services, sub-modules, etc.) needed to build a system, in terms of nomenclature, compatibility (which items can be connected or associated to others) and options, which can be added to meet specific needs. Companies typically offer several variations of families of systems, all based on a common nomenclature. For example, a bicycle manufacturer will be able to offer its customers basic bicycles, road bikes, mountain bikes, children's bikes, women's bikes, etc. Two policies for formalizing knowledge in the form of GMs can thus emerge: 1) the GM formalizes all the knowledge and diversity proposed for all families of systems, 2) the GM formalizes only the knowledge and diversity specific to a family of systems; in this case, several GMs ranging from the most generic to the most specialized family cover the proposed diversity. It is thus possible to derive from a generic GM, the other more specific GMs. This specialization of generic models (from a basic bike to a competition road bike for children) can be achieved via a specialization mechanism between models. In this communication, we focus on this modeling problem by studying the complexity of the different models according to the chosen modeling policy. This complexity could be measured using the density of the model, its maximum degree, its number of vertices, etc.

Keywords
Configuration, Modeling, Specialization, Complexity assessment

Biography / Biographies

Élise Vareilles is currently as a Full Professor of Industrial Engineering & Artificial intelligence at tISAE SUPAERO, France. She received her Msc in Computer Science from the University of Toulouse, France in 2002, her Ph.D. in

Industrial Engineering from the University of Toulouse, France in 2005 and her accreditation to conduct research from IMT Mines Albi in 2015. She works on the development of interactive aiding design tools based on knowledge and is part of the development and the improvement of the CoFiADe software. Since 2005, she has supervised 10 thesis and she has been involved in 6 national or international research projects, always with industrial partners. She is the co-author of more than 60 papers including 20 articles in Web of Sciences journals and 40 papers in high level international conferences with a selective committee. Since January 2020, she has been the leader of the Decision System research group of her lab.

Michel Aldanondo Michel Aldanondo graduated from Ecole Normale Supérieure de Paris Saclay and got his PhD from Toulouse LAAS CNRS France. He is a Full Professor since 1998 and former Director of the Industrial Engineering Center of Toulouse University IMT Mines-Albi, France. He teaches some design and operation management courses mainly at the graduate level. He concentrates his researches on the development of interactive knowledge based aiding design tools. He has directed 15 PhD students and more than 120 master students. He has published more than 160 articles in journals and conference proceedings.

Thierry Coudert is currently an associate professor in Industrial Engineering at ENI Tarbes, France. He received his Phd from the University of Toulouse, France in 2000 and her accreditation to conduct research from the University of Toulouse, France in 2014. He works on the problem of reusing experiences and knowledge for decision support, particularly in systems engineering. The various activities of a system engineering process can indeed be helped by the exploitation of explicit knowledge and/or experiences by adapted tools. He has directed 8 PhD students and has published more than 60 articles in journals and conference proceedings.

Maryam Mohammadamini is currently as a PhD student of Industrial Engineering at ENIT / LGP Tarbes, ISAE SUPAERO and IMT Mines Albi. She currently works on product configuration, knowledge modeling, specialization mecanismes and ontology.