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Models and their Foundational Framework

ABSTRACT. The term model is mainly used in two meanings which are considered to be different: a model of a problem domain as a conceptualisation; a model of a set of formulas as an interpretation in which every formula within this set is true. A general theory of models has not yet been developed. H. Stachowiak proposes a phenomenal approach and 'defines' models by their properties of mapping, truncation and pragmatics. Meanwhile, a notion of the model has been developed. At the same time, it seems that there are rather different understandings of model in sciences and especially Mathematical Logics. Sciences treat models as reflections of origins. Mathematical logics considers models as an instantiation in which a set of statements is valid. So, mathematical model theory is often considered to be a completely different approach to modelling. We realise however that mathematical model theory is only a specific kind of modelling. We show that the treatment of models in logics and in sciences can be embedded into a more general framework. So, the theory of models is based on a separation of concern or orientation.

KEYWORDS: models, mathematical model, instrument, framework, unifying theory.

1. Introduction

Modelling is a topic that has implicitly been in the center of research in science and engineering since its beginnings. It has been considered as a side issue for long time. During the last 40 years it has gained more attention and becomes nowadays a subdiscipline in many disciplines. The compendium [TN15] introduces models in agri- culture, archeology, arts, biology, chemistry, computer science, economics, electrotechnics, environmental sciences, farming, geosciences, historical sciences, languages, mathematics, medicine, ocean sciences, pedagogical science, philosophy, physics, political sciences,