Translation of materials modelling: strategy for engineering and industry to involve modelling innovations into manufacturing and business decisions.

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ABSTRACT

Involvement of materials modelling into engineering and manufacturing process plays a key role for the development of new materials and products for the European market as well as for general analysis of the design of materials properties like strength, ductility, damage and corrosion resistance, fracture and fatigue properties, and other multi-physical material characteristics. This complex task could be realized by means of efficient translation process, namely translating industrial problems into efficient and feasible materials models.

Understanding the main role of materials modelling translation and its actuation by so-called Translators at the interface between industrial end-users on one side and software owners / model creators on the other side are the key points of the European Materials Modelling Council (EMMC, http://emmc.info) activity.

The European Materials Modelling Council focuses on materials modelling integration into industry. Materials modelling is considered a European Science & Technology asset but needs far more implementation and use in business to achieve its full economic impact. Required Translators are multi-talent people (so-called “solution architect” or “project driver”) who comprehend, analyze and are aware of modelling solutions which are effective for industrial problems [1]. They are primary players for promoting the link between materials modelling and industrial progress.

Translators support the usage of materials modelling in industrial R&D as much as experiments are used today. The Translator works on the interface between business and R&D during all stages of the development (design, testing, up-scaling, market introduction). Translators should focus on the industrial problem. Before any possible modelling workflows or simulation cases are proposed, a full understanding of the problem and its industrial context is necessary. Translators support the implementation and utilization of modelling and simulation by enhancing the skills of the industrial operators.

An example of the translation approach concerning the modelling of a coupling problem of material degradation due to electro-chemical corrosion and mechanical loading is discussed in the talk. Simulation and experimental investigation of surface degradation and material damage due to combination of aggressive environment attack together with mechanical loading is in the focus of this approach. Therefore, a continuum model of chemical, electrochemical reactions and related species transport is coupled with continuum solid mechanics model.

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The aim of the study is to understand the influence of corrosion related geometry and morphology changes on its mechanical properties.

Additionally, microstructure analysis of corrosion morphology is carried out to understand the mechanism of defect initiation and damage evolution in the test specimen subjected to intensive mechanical loading in the active chemical environment. The experimental data is used for the modelling validation.

References

1. Anne F. de Baas, “Review of Materials Models (RoMM): What makes a material function? Let me compute the ways”, (2017). https://bookshop.europa.eu/en/what-makes-a-material-function--pbKI0616197/.