
Written by: Mauricio Barrera

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Communication strategy

I considered my current situation as a Master student and the main reason to decide enrolling in it. Personally, I wish getting high quality mentoring for my learning process, whose aim is to enable myself to apply modern mathematical and computer based techniques to the treatment of relevant challenges in engineering research. Hence, the audience I want to address are knowledgeable individuals keen to mentor students through having them participate in their current projects.

The strategy consists on offering evidence of the ability to synthesise a research hypothesis in a field with a very large and complex body of literature. This is made by means of the “Title” and “Abstract” below.

Title: Friction Stir Welding (FSW) modelling and multi-scale approach: a potential step forward in understanding the process and inspire new ones

Abstract

FSW is a technology still with potential grow, either on its own right or to unveil new approaches to metal joining. This comes from achievements in understanding the process through the interplay between materials characterisation and mathematical modelling.

The latter shows that FSW is a strongly coupled scenario, where mechanical and thermal effects prevail in determining its evolution. Available material characterisation techniques give account of the predictive capability of such models and are used to aid engineering decision-making in specific manufacturing scenarios.

Nonetheless, these achievements and the ever existing room for improvement suggest that the models should now extend into microstructural details of the process, for it is widely known that they play a very important role in the result.

Then again, a top-bottom approach to link continuum mechanics phenomena with microstructural features of materials, known as multi-scale modelling, has grown over the last decade as an independent field which has produced validated modelling and implementation methodologies. Furthermore, it has capitalised on developments on parallel computation, in addition to decidedly enforcing a high degree of interaction among physicists, mathematicians and engineers.

On these grounds, it seems natural that the multi-scale consideration of material microstructure evolution and its relation to continuum properties could be a promising step forward for FSW

modelling. A question of industrial relevance that would lead efforts into the proposed approach is that of studying the microstructural events in the Heat-Affected Zone in materials highly sensitive to welding parameters, such as some aluminium alloys.

Proper understanding and effective implementation of a blend between multi-scale and continuum modelling should, in addition to solving specific FSW problems, set forth a modelling frame within which further possibilities of this process can be identified and ideas for materials modelling-based technological innovations can be inspired.