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111_Design and Analysis of independent suspension system of FSAE vehicle

BOOK OF ABSTRACT

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Numerical Modelling of Plastic Behaviour and Temperature Distribution during FSW Process

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Abstract: Friction stir welding is widely used to weld those materials that are difficult to weld through conventional welding processes. A larger number of literatures have been reported to explore the process performance characteristics; however, details of plastic behaviour during the process have not yet been completely illuminated. Hence in the present study, a 3D coupled thermo-mechanical model based on the Lagrangian analysis method is developed to study the temperature profile and plastic behaviour developed during FSW process by using DEFORM-3D software. In addition, the results have been modified using a stepped tool in butt welding of Aluminium alloy 7075. The workpiece and tool are modelled as viscoplastic and rigid material respectively. Sticking condition and constant shear friction model have been used to define inter-object relation. As, large plastic deformation occur during FSW process so an adaptive autoremesh technique has been used to eliminate the mesh distortion developed during the analysis. Further, model validation has been done by comparing the existing simulation and also investigation of the temperature distribution, effective strain and effective stress has been done which is developed during process in the welding zone. The analysis precisely shows the unsymmetrical nature of the FSW process and observed that strain distribution is asymmetric and temperature distribution is nearly symmetric along the welded joint. The highest temperature has been observed on the upper surface of the workpiece. Further, thermal and plastic behaviour through the conventional FSW tool have compared with the stepped FSW tool and observed that there is increased in strain and temperature developed during FSW process result in increase in joint efficiency.

Keywords: Friction stir welding, Finite element analysis, Temperature profile, Plastic behaviour, Stepped tool

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Design and Analysis of independent suspension system of a FSAE Vehicle

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Abstract: In Formula Society of Automotive Engineers (FSAE) the design of suspension system is one of the most important area on which performance of vehicle depends. Present study proposes the procedure in designing a double wishbone independent suspension system for FSAE cars. This paper details the procedure utilized for design and analysis of mechanical systems which can be utilized within the FSAE vehicle norms. Suspension geometry is specified on basis of FSAE guidelines, packaging constraints and desired performance parameters. Forces are calculated based on weight of vehicle and weight transfer while riding. Suspension geometry is designed and linear Static Stress analysis on the suspension system is done considering forces, space availability and safety aspects for optimum performance.

Keywords: FSAE, Independent suspension system, Motion analysis, Suspension design, Linear Static analysis.

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Double arrowhead auxetic structures: A numerical investigation under compressive loading

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Abstract: A new class of metamaterials known as auxetic/negative Poisson's Ratio (NPR) structures have wide applications in fields where high energy absorption and stiffness is required. The present work is focused on numerical investigation of double arrowhead (DAH) auxetic structures of poly-lactic acid (PLA) material under compressive loading. Deformation mechanism of DAH auxetic structures is studied for different configurations by varying geometrical parameters namely first angle (θ_1), second angle (θ_2), and half-length (l). Nonlinear finite element models are developed for compressive loading and responses namely strength, modulus and specific energy absorption (SEA) are measured. It is found that all geometrical parameters significantly influence the responses of DAH auxetic structures. With increase in first angle, strength and modulus increases while SEA decreases. Responses increase with rise in second angle and reduction in half-length of unit cell of DAH auxetic structure.

Keywords: Auxetic structures, Poisson's Ratio, Double arrowhead structure, Geometric parameters, Compressive strength, Stiffness, Specific energy absorption

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