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Thermo-mechanical modelling of an aircraft tire: Numerical and experimental aspects

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The main interest of a fully coupled thermo-mechanical tire model is to predict the tire behaviour in critical situations. This talk presents some experimental and numerical aspects of the heating mechanisms of an aircraft tire. The temperature of a tire rises mainly from the heat generated due to hysteresis effect and from the frictional work in the contact zone converted into heat flux. Several runs have been done on a mobile test rig for different speeds, loads and skidding angles and the temperature evolutions have been recorded by an infrared camera. The experimental results show first a high temperature rise stage followed by a second one corresponding to lower temperature rates. The initial part comes from the inelastic dissipation effects, while the "plateau" comes from frictional work transformed into heat flux. We know that rubber-like materials exhibit a hysteretic behaviour under cyclic loading that leads to a rubber heat build-up. In order to study this rubber heating phenomena, cyclic loading on tire tread specimens equipped with thermal sensors inside was applied. As it was expected, the results confirmed the first heat build-up stage. The numerical model considers that all the inelastic energy is completely converted into volumetric heat. For the second heat-up stage, it was considered that all the frictional work is converted into heat. A comparison with the real measurements was done by warming-up the tire tread using a thermal paint burner at different temperatures and measuring simultaneously the temperature evolution on the tread surface and inside the tire structure.

Biography

Iulian Rosu completed his PhD from Paris-Nord University in 1996. Since 1999, he is a Research Engineer at the Laboratory of Mechanics and Acoustics in Marseille, France. From 1991 until 1993, he/she was a Research Engineer at the Laboratory of Mechanical and Thermo-mechanical Properties of Materials in Villetaneuse, France. From 1986 until 1990, he worked as a Research Fellow at the Laboratory of Solid Mechanics in Bucharest, Romania. His main research activities are numerical modelling of aircraft tyre rolling, numerical modelling of adhesion and deep drawing of metal sheets.

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