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Analytical modelling of the ball pin and plastic socket contact in a ball joint

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Abstract

This paper presents an analytical approach to study the failure of suspension ball joints. This degradation occurs at the plastic socket/ball pin interface and is considered as the result of the complex loading that undergoes the ball joint during its lifetime. The developed approach reproduces this loading by estimating both the contact pressure profile and the displacement field for the plastic socket elements. The contact pressure was identified for the studied ball joints after fitting with the numerical simulation results based on the real load cases and motion solicitations. The displacement field has been identified by parameterizing elements of the plastic socket at the contact interface according to the motion solicitations. Thereby, the plastic socket wear has been analyzed based on the modified Archard’s law. A confrontation with experimental tests on an automotive ball joint was carried out. The analytical model predicted well the localization of degradation zones on the plastic socket. It was highlighted in this study that the motion solicitations history has an effect on the overall wear.

Keywords: Ball joint; Contact interface; Analytical modelling; Polymer; Wear