
EXPERIMENTAL MEASUREMENTS OF THE STRESSES IN THE LOWER LINK OF THE THREE-POINT HITCH MECHANISM

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Abstract

Agricultural machines and their implements are subjected to dynamic loads during farm operations. Depending on the type of operation (e.g. lifting or plowing), lower links of the three-point hitch mechanism are exposed to stresses caused by combination of bending moments and axial forces. In this paper we analysed influence of the soil resistance during plowing on the lower link and the possibility of its failure. The stresses were measured using strain gauges at locations with uniform stress distribution in order to enable more reliable comparison with finite element analysis (FEA). Recorded stresses vs. time were used for identifying mean stresses and amplitudes for different plowing depth and different tractor speeds. Due to the geometry of the lower links and their joints in the three-point hitch mechanism, during plowing and transferring soil resistance, links are loaded not only by axial forces but also by bending moment in the horizontal plane. Under some assumptions, FEA provided us to make relations between the measured stresses and the loads that caused them. Measured stresses show that links have significant safety margin relative to tractor installed power and soil resistance, which enables the possibility of their design optimization. Obtained results may also serve for further analyses of fatigue life prediction, measurement of the draft forces etc.

Keywords

Three-point hitch mechanism, lower link, stress state, strain gauges, finite element analysis

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