Single-point incremental forming and formability-failure diagrams - DTU Orbit (12/08/2019)

Single-point incremental forming and formability-failure diagrams
In a recent work [1], the authors constructed a closed-form analytical model that is capable of dealing with the fundamentals of single point incremental forming and explaining the experimental and numerical results published in the literature over the past couple of years. The model is based on membrane analysis with in-plane contact friction forces but is limited to plane strain rotationally-symmetric conditions. The aim of the present paper is twofold: (i) to extend the previous closed-form analytical model into a theoretical framework that can easily be applied to the different modes of deformation that are commonly found in general single point incremental forming processes; and (ii) to investigate the formability limits of SPIF in terms of ductile damage mechanics and the question of whether necking does, or does not, precede fracture. Experimentation by the authors together with data retrieved from the literature confirms that the proposed theoretical framework is capable of successfully addressing the influence of the major parameters of the single point incremental forming process. It is demonstrated that neck formation is suppressed in SPIF, so that traditional forming limit diagrams are inapplicable to describe failure. Instead fracture forming limit diagrams should be employed.

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