On the significance of the convexity of the yield limit

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Convexity of a function or set is an often needed and important mathematical property. In case of yield limits (or elastic ranges) in terms of stresses, almost all empirical and mechanism-based yield limits have this property. However, requiring positive plastic dissipation does not necessarily exclude non-convex yield limits [1,2], which is furnished by the fact that non-convex yield limits are observed experimentally, although this happens rarely [3]. We therefore ask whether this nice mathematical property reflects an interesting physical material property. This is investigated in an elastic-plastic, small strain, plane stress setting in a descriptive, empirical manner. It turns out that at least in this setting, no specific material property can be attributed to the convexity of the yield limit.

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