## **MRCT** element with a Dislocation Based Plasticity Model

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## ABSTRACT

The multiresolution continuum theory (MRCT) [1] has been established to link the material's macroscopic behaviour with its microstructural inhomogeneities. Additional kinematic variables in addition to the conventional macroscopic displacement field are added to account for microstructural deformations at multiple microscales. With the length scale parameter directly embedded in the constitutive equations, the mesh dependent phenomenon is remedied.

Metal plasticity is associated with interaction of motion of dislocations and microstructures. A Dislocation density based material model [2] calibrated and validated for AISI 316L at different temperatures and strain rates is used as the macroscopic constitutive equation of the MRCT element. The model can be used to describe the hardening/softening behaviour due to competing hardening, recovery and vacancy migration mechanisms. It has been used for forming of the titanium alloy Ti-6Al-4V [3] and the aluminium alloy AA5083 [4]. The basic form of the model is

$$\sigma_y = \sigma_G + \sigma^*$$

(1)

where  $\sigma_{G}$  is an athermal stress contribution due to the long-range interactions of the dislocation

substructure.  $\sigma^*$  is a friction stress needed to move dislocations through the lattice to pass shortrange obstacles. For further information that relates these stress contributions with various deformation mechanisms, please refer to [2]. The temperature effect has been included in the MRCT element and we investigated particularly how the changing properties of the microdomain with changing temperature affect the macroscopic behaviours of the material.

## REFERENCES

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