A CONSTITUTIVE MODEL FOR THIXOTROPIC-ELASTO-VISCOPLASTIC FOR MATERIALS THAT ADMITS CLASSICAL AND NON-CLASSICAL YIELD STRESS

R.L. Thompson[1], P.R. De Souza Mendes[2]

1 - Mechanical Engineering Department -LFTC-LMTA-PGMEC-UFF, Brazil
2 - Mechanical Engineering Department - PUC-Rio, Brazil

rthompson@mec.uff.br

There is an important controversial issue that is present in the literature of viscoplastic materials that is related to the existence or not of the so called *true yield stress*. A true yield stress is a stress limit below which the material do not flow. This behavior was first modeled by Bingham (1916) in his seminal work. Barnes (1999) made an important review article on the topic and showed that some materials that were considered yield stress materials in the classical sense, in fact flow before the yield stress limit was achieved. In this connection the yield stress was considered a property that is related to a limit where the material, at a very high viscous state, starts a sudden micro-structure collapse and goes to a low viscous state.

Thixotropic materials are yield stress materials. Till nowadays, most of the models adopt either one or the other concept behind yield stress to construct the thixotropic behavior of the material. In the present work we developed a thixotropic-elasto-viscoplastic model that joins the two possibilities in the same backbone. Taking the model developed by de Souza Mendes (2010) as a starting point, this is done using a new model for the relation between the structural viscosity and the structural parameter. One of the key assumptions is that this structural dependency can lead to a viscosity of the totally structured material which can be infinity or a finite value η_0. The evolution equation was also modified to accomplish the desired features.

The model is used to a direct comparison between the two philosophical approaches which are made for shear flows.