

# *Dymore User's Manual*

## Formulation of dashpot elements

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## 1 Representation of damper characteristics

Damper characteristics are defined by the coefficients of the expansion of the force-stretch rate relationship in term of Chebyshev polynomials

$$F_{vi}(\mu) = \sum_{i=1}^N c_i T_{i-1}(\mu), \quad (1)$$

where  $T_i$  are the Chebyshev polynomials,  $c_i$  the coefficients of the expansion,  $N$  the number of terms in the expansion, and  $\mu$  the non dimensional stretch rate defined as

$$\mu = \frac{2v - (v_{hi} + v_{lo})}{v_{hi} - v_{lo}}. \quad (2)$$

$v_{lo}$  and  $v_{hi}$  are the lower and upper bounds defining the range over which the approximation is valid. If the stretch rate of the damper goes beyond this range during the simulation an error message will be printed.

## 2 Formulation of damper elements

The damper element generates a damping force,  $F^d$ , that is a function of the relative velocity of the damper,  $v$ , such that

$$F^d = F^d(v). \quad (3)$$

The power of the damping force is *positive definite function of the relative velocity*, i.e.,  $vF^d(v) \geq 0, \forall v$ . The stiffness of the damper, denoted  $k$ , is then obtained by taking the derivative of the damping force with respect to the relative velocity,

$$k = \frac{dF^d}{dv}. \quad (4)$$