Drawing of Glass Fibers: stability and time dependence.

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Modeling of the drawing of glass fibers has a long history [1] A previous MPI session looked at the high-speed drawing of opticals fibers; for example, how a planar interface is distorted by the drawing process [2]. In this session we examine the stability of the flow and the assumptions underlying estimates of diameter variation and time dependence. Current interest in the time dependence derives from

(A) improved measurement techniques [O3], [L4]

(B) estimates of the ability of the fiber draw process to achieve higher tolerances [B5], [C6], [B7], [L8]

(C) drawing heterogeneous materials for photonics applications [Fitt9], [Fitt10](includes discussion of stability) ,[P11], [IMA12] , as well as the effect of variable viscosity due to dopants [C13]. The effect of variable viscosity has ties to modeling of the distortion of viscous inclusions [Spence14] including the effect of “boudinage” {French for sausage} discussed in the geology literature [Spence15]

Arguments have been made both that the time dependence can be chaotic [Y16] and unconditionally stable [G17].

In this workshop we would like to make progress on an understanding of the limitations of optical fiber diameter control, perhaps adapting the work of Spence et al. to estimating diameter fluctuations, reviewing the assumptions related to “small nonlinear” diameter variations, and quantifying the importance of various factors.

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[G17] Gupta et al., “Non-isothermal model of glass fiber drawing stability”, Rheol Acta (1996) Vol. 35 pp. 584-596.