Numerical analysis of magneto-electrospinning

To cite this article: L Xu and Y Wu 2008 J. Phys.: Conf. Ser. 96 012208

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Numerical analysis of Magneto-electrospinning

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Abstract In this paper, a discrete model is used to simulate the bending instability in Magneto-electrospinning. The effect of magnetic field on the instability is numerically studied.

Electrospinning technology is a very effective and economical method for producing nano-fibers, and it becomes a hot subject in nanoscience and nanotechnology. During the electrospinning process, the charged jet is of intrinsic instability that leads to the uneven construction of nano-fibers and waste of most energy which, otherwise, can be used to further pull the jet into even more smaller fibers.

Fig. 1 Magneto-Electrospinning Setup (1-pump, 2- nozzle, 3,4-high voltage supply, 5- excitation coil, 6- grounded collecting plate, 7- resistance)[2]

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This paper studies numerically effects of magnetic field on the instability of the charged jet of magneto-electrospinning [1]. The numerical results, where Runge-Kutta method is used, and a discrete model is suggested, show that the produced magnetic force can not only control the instability, but also ameliorate inner structure of macromolecules, results in remarkable amelioration of nanofiber’s strength.

Numerical comparison with classic electrospinning procedure reveals that magneto-electrospinning can completely control the instability in case of infinite large magnetic field, so that the electric force can be used, without any waste, to improve jet’s velocity extensively, as a result, much smaller nanofibers can be obtained.

Acknowledgements
The present work is supported financially by grant 10372021 from National Natural Science Foundation of China and by the Program for New Century Excellent Talents in University.

Reference
[1] Yue Wu, Jian-Yong Yu, Ji-Huan He and Yu-Qin Wan 2007 Chaos Solitons Fractals 32 5-7