



Discussion

Discussion: “Analysis of Stresses Induced by Dynamic Load Head-Disk Contacts” (Fu, Ra-Chang and Bogy, David B., 2000, ASME J. Tribology, 122, No. 1, pp. 233–237)

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The authors developed a valuable method for estimating the impact stress caused by dynamic load head-disk contacts. Based on existing experimental database, they extrapolated the desired radius of curvature for slider rounding. This approach is useful as it enables to extrapolate parameters from larger form factor slider to smaller form factor one. In practice, the measurement of the motion of smaller form factor slider is usually difficult as the slider is fully covered by suspension. However, the derived stress model as represented by Eqs. (12)–(13) are arguable. By using the equilibrium of energy in the impact deformation process, we obtained the following formulation for the maximum contact stress:

$$\sigma_m = C(E^*)^{4/5} M^{1/5} V^{2/5} R^{-3/5}, \quad (1)$$

in which C is a numeric value. This formulation is different from the model given by the authors.

A check shows that the above Eq. (1) is consistent with the ratio of maximum normal stresses for different radii of curvature

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Table 1 Extrapolated radius of curvatures of Nano slider and Pico slider needed to achieve at least 100,000 cycles of dynamic load head-disk interface durability with a vertical loading speed of 50 mm/s

Slider form factor	Radius of curvature at the slider's contact corner (mm)	
	Current Eq.(1)	Eqs.(12)-(13) in (Fu and Bogy 2000)
70% slider	0.85	0.85
Nano slider	0.67	0.34
Pico slider	0.41	0.05

given by Suk and Gillis [1], whereas the authors' Eqs. (12)–(13) are in contradiction to it. A further check shows that the authors' Eqs. (12)–(13) are not consistent with the Hertz's solution [2] which is also cited as Eqs. (2) and (5) by the authors.

This leads to another problem with respect to the authors' extrapolation results. Based on the above Eq. (1), we re-estimate the desired parameters for a dynamic load slider in terms of the same stress level as defined by the authors. The obtained radii of curvatures are summarized in Table 1. From the table, it can be seen that there are significant differences between the results obtained from the above Eq. (1) and the authors' results.

We still remain impressed by the depth of the paper, even though we wish the authors' model to be consistent and the extrapolated results to be more accurate.

References

- [1] Suk, M., and Gillis, D. R., 1998, "Effect of Slider Burnish on Disk Damage During Dynamic Load/Unload," ASME J. Tribol., **120**, pp. 332–338.
- [2] Johnson, K. L. 1985, *Contact Mechanics*, Cambridge University Press, Cambridge.