Journal of Sound and Vibration (2001) **240**(5), 955–956
doi:10.1006/jsvi.2000.3166, available online at http://www.idealibrary.com on IDEAL®

LETTERS TO THE EDITOR

COMMENTS ON "INCREASING THE NATURAL FREQUENCIES OF CIRCULAR DISKS USING INTERNAL CHANNELS"

P. A. A. LAURA, D. V. BAMBILL, C. A. ROSSIT AND S. LA MALFA

Institute of Applied Mechanics (CONICET) and Department of Engineering, Universidad Nacional del Sur, 8000 *Bahía Blanca, Argentina*

(*Received* 22 *March* 2000)

Professor A. A. Renshaw has presented a very thorough and interesting analytical and experimental investigation on an ingenious, novel design of computer disk drive disks that raises their natural frequencies [1].

It may be of interest to point out that the procedure of raising the natural frequencies by adequately subtracting mass from the structural element under consideration is usually defined as "dynamic stiffening" [2–8]. On the other hand, in general, studies performed in the past have been mainly concerned with raising the fundamental frequency. The study performed by Renshaw [1] is also highly successful in the sense that several lower natural frequencies of the structure are raised. Following reference [7] the use of the dynamic stiffening efficiency factor, η, may be convenient, and defined as

$$\eta = \frac{\omega_1^s/\omega_1^0}{M_s/M_0}, \tag{1}$$

where ω_1^s is the fundamental circular frequency of the dynamically stiffened structure, ω_1^0 is the fundamental circular frequency of the virgin structure, M_s is the total mass of the stiffened structure, and M_0 is the total mass of the virgin structure.

Expression (1) can be conveniently extended to the case of higher natural frequencies. Clearly, the problem under consideration belongs to a special chapter of optimization theory. Among the topics which may be investigated are, for instance, decreasing the total mass of the structural element keeping constant its fundamental frequency [5]; maintaining constant the total mass of the structure and increasing its lower natural frequencies [7], etc.

ACKNOWLEDGMENTS

The present study has been sponsored by CONICET Research and Development Program and by Secretaria General de Ciencia y Tecnología of Universidad Nacional del Sur.

REFERENCES

1. A. A. RENSHAW 2000 *Journal of Sound and Vibration* **229**, 355–376. Increasing the natural frequencies of circular disks using internal channels.
2. G. SUBRAMANIAN and T. S. BALASUBRAMANIAN 1987 *Journal of Sound and Vibration* **118**, 555–560. Beneficial effects of steps on the free vibration characteristics of beams.

0022-460X/01/100955 + 02 $35.00/0

3. P. A. A. LAURA, R. E. ROSSI and M. J. MAURIZI 1991 *The Shock and Vibration Digest* **23**, 307–312. Dynamic stiffening of structural elements.
4. R. E. ROSSI and P. A. A. LAURA 1993 *Journal of Sound and Vibration* **160**, 190–192. Dynamic stiffening of an arch clamped at one end and free at the other.
5. P. A. A. LAURA, H. A. LARRONDO, D. R. AVALOS, D. V. BAMBILL, R. CARNICER and H. C. SANZI 1995 *Applied Acoustics* **44**, 125–132. Dynamic stiffening of circular plates and determination of their buckling, in-plane pressure.
6. P. A. A. LAURA, L. ERCOLI and S. LA MALFA 1995 *Acustica* **81**, 196–197. Dynamic stiffening of a printed circuit board.
7. P. A. A. LAURA and R. E. ROSSI 1996 *Journal of Sound and Vibration* **194**, 448–451. A truncated pyramidal cantilever beam: a convenient dynamically stiffened structural element.
8. I. HARIK and X. LIU 1991 *Journal of Sound and Vibration* **147**, 366–370. Influence of material distribution on vibration of plates.