SHOCK WAVES IN RUBBER

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Propagation of waves of finite deformation in a rubber specimen has been investigated experimentally. First, a latex rubber strip specimen was loaded by holding one end fixed and displacing the other end at a constant velocity. A high-speed video camera was used to take pictures at a rate of 40,000 frames per second to monitor the strain and particle displacement evolution with time. Subsequently, a retraction experiment was performed in which a rubber strip stretched to about five times its initial length was released at one end and the resulting unloading is again examined with a high speed camera; a fan of unloading waves was followed by an unloading shock that unloaded the specimen almost completely. The retraction experiment is a reprise of the experiments of Mason [1] but, these experimental results are interpreted with the one-dimensional theory discussed by Knowles [2]. The dispersive fan solution for this problem reproduced the measured particle displacement very well. The fan-shock, two-wave structure observed in the retraction experiment is also shown to be a feature of the one-dimensional analytical model.

References

[1] P. Mason, 1963, Finite elastic wave propagation in rubber. *Proceedings of the Royal Society of London. Series A, Mathematical and Physical Sciences*, **272**, 315-330.

[2] J.K. Knowles, 2002, Impact-induced tensile waves in a rubberlike material. *SIAM Journal ofAppliedMathematics,* **62**:1153-1175.

Keywords: finite deformation, one-dimensional waves, retraction