Dynamic Testing Brings Running into the Laboratory

The Challenge:

Predict which Materials Make the "Best" Running Shoe

Background

One of the biggest recurring expenses runners face is the cost of new running shoes. Runners who regularly log forty, fifty, or sixty plus miles a week can easily use up a pair of training flats in two months or less.

The physical properties of the materials chosen for shoe construction will determine the longevity of the shoe in addition to the perception of fit, comfort, cushion, and stability. The storage and loss modulus of the materials would seem to be key measurements to predict shoe performance.

In addition, the ability of materials to recover the original thickness and structure from step to step will influence the performance during typical running conditions.

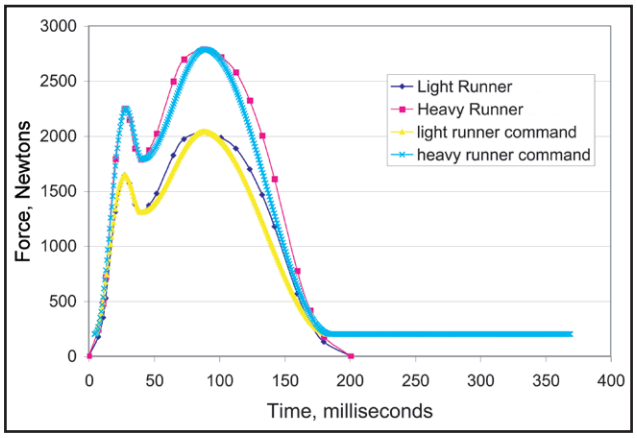
If the recovery time is greater than the time between steps, the residual compression will lead to mechanical properties different from those initially measured. Measuring the dynamic properties can help predict which materials will provide the "best" running shoe.

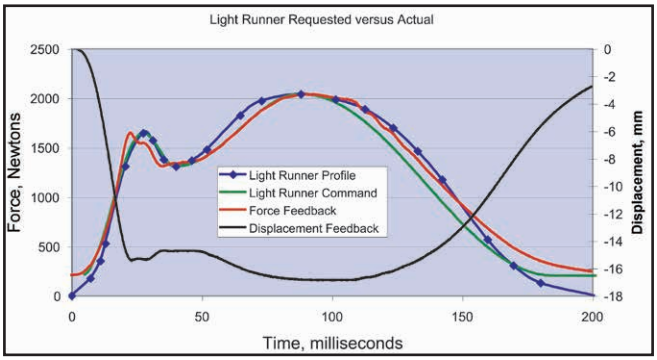
Meeting the Challenge

Researchers at a major running shoe manufacturer provided Bose with evaluation material and test conditions for a typical "light" and "heavy" runner. The pulse represents the output of a force platform for a typical heel strike and lift-off event.

The ElectroForce® 3300 test instrument with pneumatic preload was used to recreate both runner profiles in compression. An indenter developed by SATRA was used which measured 45 mm in diameter with a 37.5 mm radius on the face.

The test profiles were fit with a series of haversine segments. A dwell was added at the end of the pulse to simulate the time between shoe impact.





The force profile of the complex waveform used to simulate heel strike and lift-off was easily recreated under demanding conditions. The stiffness of the material at maximum force was over 25 times higher than the stiffness at first contact. By following the displacement feedback over a series of pulses, the compression set of the material can be tracked. The ElectroForce 3300 test instrument with pneumatic preload has shown its value in laboratory evaluations of running shoe materials.

Bose Corporation – ElectroForce Systems Group
10250 Valley View Road, Suite 113, Eden Prairie, Minnesota 55344 USA
Email: electroforce@bose.com – Website: www.bose-electroforce.com
Phone: 952-278-3070 – Fax: 952-278-3071