Glossary

Friction Response

A term related to “Effectiveness of synthetic base oils for automotive shock absorber fluids SustainaLub: balancing reduced environmental impact and ride quality”

KATO Shinji, Product Development Office, Engineering Headquarters, Automotive Components Operations

1 Friction Response

1. 1 Definition

Friction response refers to the increase in friction force that occurs immediately after the piston velocity reverses (at zero velocity) during shock absorber operation. It is a key parameter that determines the initial behavior of the shock absorber.

2 Technical Background and Importance

2. 1 Impact in the Micro-Input Range

During vehicle operation in the micro-input range, piston velocity is extremely low. This generates insufficient hydraulic damping force. Consequently, the contribution of the friction force increases relatively (Fig. 1).

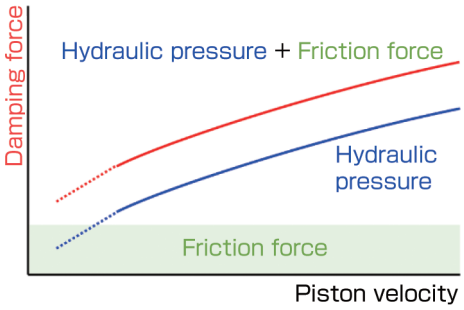


Fig. 1 Contribution of hydraulic pressure and friction force

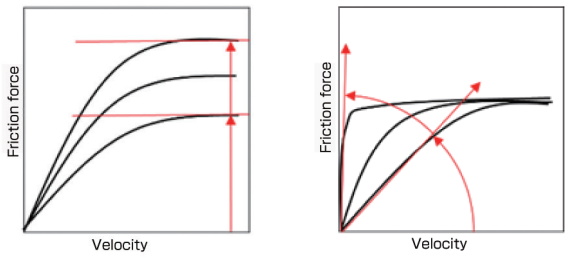
2. 2 Contribution to Ride Comfort and Handling Stability

The friction response is affected by the magnitude of the friction coefficient as well as the slope of the build-up of friction force immediately after reversal.

This initial friction behavior significantly affects the vehicle’s ride quality (sensory evaluation of ride comfort and handling stability), including steering responsiveness, sense of road contact, and ride comfort.

2. 3 Significance as a Design Factor

Shock absorbers continually experience reversals in the direction of piston movement due to vehicle motion and road surface inputs. Therefore, it is crucial to design the friction characteristics from static to dynamic friction exactly as intended (Fig. 2).



(a) Friction force (b) Friction response

Fig. 2 Conceptual diagram of friction force (a) and friction response (b)

3 Quantification of Friction Response (Spike Index, *SI*)

To quantitatively evaluate the friction response, KYB developed the Spike Index (*SI*).

3. 1 Overview of *SI*

The *SI* extracts and evaluates the abrupt changes (spikes) in the coefficient of friction that occur during transition from stationary to slipping states. The *SI* effectively evaluates ride comfort and handling stability because it directly assesses the quality of the friction response based on behavior during speed reversal.

3. 2 Application Results

Dynamic friction characteristic evaluation and control technologies using the *SI* received the FY2022 Technology Award from the Japanese Society of Tribologists (JAST). A related technology was registered as Patent No. 7156903.