APPLICATION NOTE

MTS Rolling Contact Fatigue (RCF) Testing Machine

Rolling Contact Fatigue (RCF) is the study of surface damage, subsurface damage, and degradation between rolling bodies caused by fatigue.

The MTS RCF Test System simulates interaction between the rolling wheelset and rail by:

» Programmable operating conditions offering a wide variety of study options

» Repeatable cyclic loading ensuring engineering-level information
  – Differences in specimen response can be accurately quantified
  – Tests can be repeated on future specimens

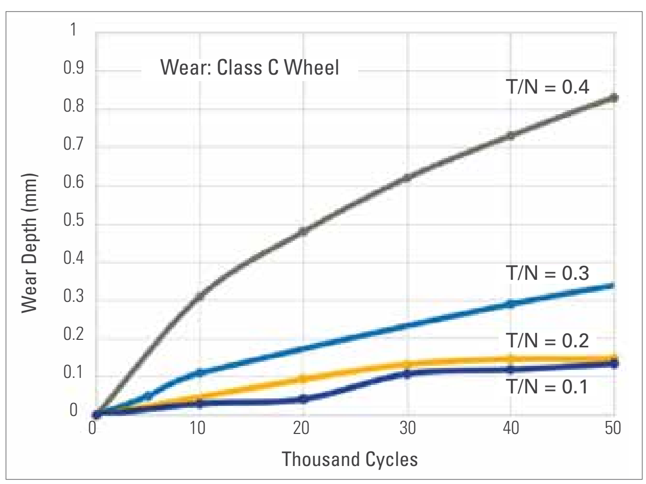
» Local instrumentation accurately measures response

» Allows study of discrete events:
  – Straight rolling
  – Flanging
  – Curving
  – Mapping of lateral force vs Angle of Attack

CONCEPT ADVANTAGES

» Fixed (rigidly mounted) specimen wheelset:
  – All loads are read directly where they are reacted, no swivels or other sources of hysteresis
  – No kinematic compensation required, specimen and load cells are always in the same DOF coordinate system
  – No inertial compensation is required, load cells do not move
  – Instrumented wheelset (customer supplied) does not move in space therefore accuracy is increased
  – Actuators do not move relative to specimen, gain is constant for all DOF

» Rail carriage supported on hydrostatic bearings:
  – Proven design with hundreds of units in operation (patented by MTS in 1976)
  – Low friction teflon seals with light preload
  – Low noise and vibration, smooth operation on pressurized pad of oil
  – No bearing wear, long life, limited maintenance
  – Extremely rigid, highly repeatable response



Graphic courtesy TTCI and FRA

SYSTEM SPECIFICATION

- Vertical: 667 kN; 63 mm
- Lateral: 374 kN; 63 mm
- Longitudinal: 67 kN; 1.2 m; 1.6 m/s (6 kmph)
- AOA: 40 mrad; Resolution: 0.004 mrad
- Wheel torque: 4,000 n-m
- Wheel encoder accuracy: 0.0027° (0.024 mm on a 1m diameter wheel)
- Minimum turn radius: 300 m
- Unidirectional or bi-Directional

Uni-Directional Profile Example

- 0.54 Hz
- 1.65 m/s velocity[1]
- 0.381 m constant velocity zone[2]
- 6.51 m/s^2 accel (0.66 g)
- Zero Lateral
- 8 mrad Uni-directional angle yaw (Programmable)
- 0.505 m amplitude (1010 mm Total Stroke Distance)

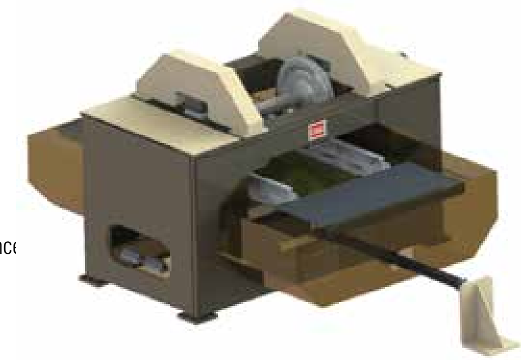
Bi-Directional Profile Example

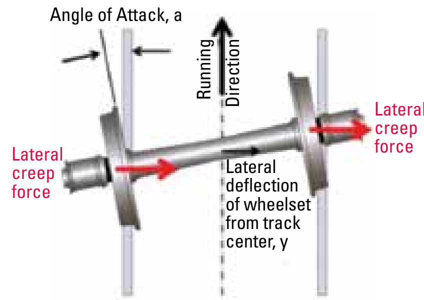
- 0.5 Hz
- 1.65 m/s velocity[1]
- 0.381 m constant velocity zone[2]
- 6.6 m/s^2 accel (0.67 g)
- Zero Lateral
- 8 mrad bi-angle yaw (programmable)
- 0.618 m amplitude (1236 mm Total Stroke Distance)

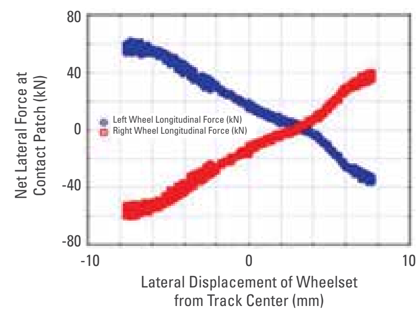
Note:
[1]Optional higher velocity up to 2.5 m/s.
[2]Optional constant velocity zone up to 3.5 m

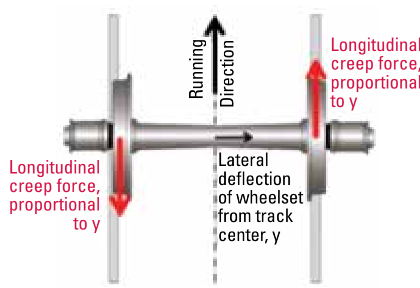
IMPORTANCE OF FIXED WHEELSET & POSITION CONTROLLED RAIL

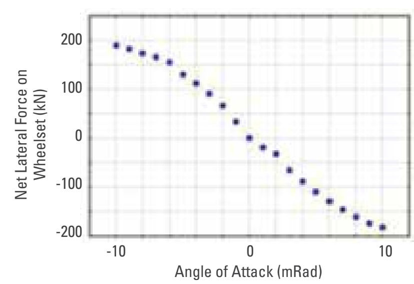
- Accurate reproduction and control of wheel-to-rail lateral position and angle of attack (AoA) is required for generation of correct contact forces
- Wheelset forces change with rolling distance

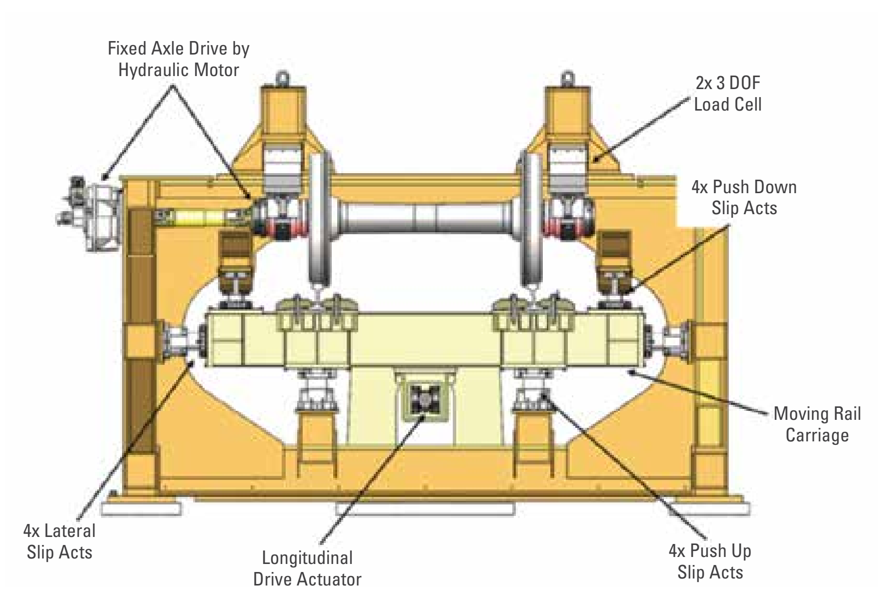












Graphic courtesy TTCI and FRA

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