Thermo-mechanical ratcheting in soil?structure interfaces

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This paper proposes and validates a thermo-mechanical ratcheting mechanism that explains the cumulative displacement of soil?continuum interfaces when subjected to temperature cycles and bias forces. The study provides experimental evidence of the mechanism from a physical model consisting of a rectangular, solid prism, that is subjected to temperature cycles and a static bias force aligned parallel to the interface, while resting on a horizontal granular material bed. The experimental results show that the thermally driven displacement accumulates with the number of temperature cycles in the direction of the bias axial force application. In addition, the displacement accumulation rate decreases with the static factor of safety against sliding of the interface and increases with the amplitude of the temperature cycles. FEM thermo-mechanical simulations of the physical model confirm the experimental findings. Finally, the gov