DYNAMIC CHARACTERIZATION OF LUNAR SIMULANTS USING RESONANT COLUMN PROCEDURES.

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Abstract: Stiffness degradation and viscous damping ratio curves provide the necessary elastic and dissipative parameters required to characterize soil deposits for dynamic analyses. Although extensive research has been performed to measure and document shear strain (γ)-dependent shear moduli ($G(\gamma)$) and viscous damping ratios ($\xi(\gamma)$) for soils encountered in Earth-based construction practices, these dynamic geotechnical properties have not been investigated for lunar regolith. This represents a significant limiting factor in our abilities to predict lunar regolith's physical reactions when exposed to the multitude of dynamic loading situations that will be encountered in the exploration and colonization of the lunar surface. The objective of the presented study is therefore to perform the first small-strain dynamic investigations of lunar regolith, using a resonant column apparatus upon a variety of lunar simulant specimens. In addition to JSC-1, a series of newly manufactured advanced simulants (ZAP™) including agglutinates will be used for dynamic property comparisons. The resonant column device used is a fixed-free torsional device capable of generating $G(\gamma)$ and $\xi(\gamma)$ curves along the small strain range of 10^{-4}% to 0.10% under isotropic stress conditions. The dynamic properties of the various simulants and their usage and implications in lunar exploration and construction are then discussed.