Mechanical behavior of concrete filled glass fiber reinforced polymer -steel tube under cyclic loading

混凝土填充的玻璃纤维增强型聚合物钢管在周期载荷下的力学性能

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Main goal

The experimental and numerical investigations of mechanical behavior of concrete-filled glass fiber reinforced polymer (GFRP)-steel tube structures under combined seismic loading are described.

Main aspects

Quasi-static test system testing, establishment of finite element model, parametric analysis.

Testing setup

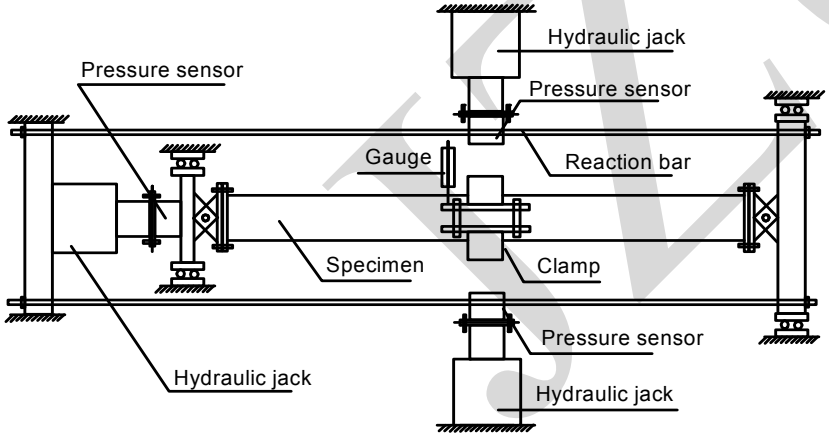

Fig. 1 Loading schema

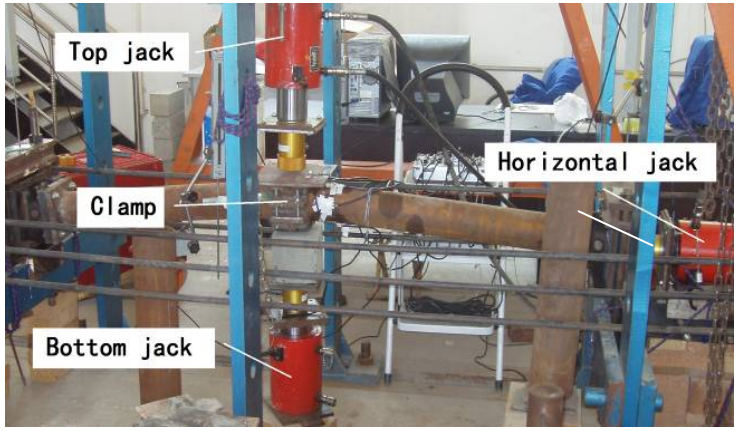

Fig. 2 Loading system

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Conclusions

1. GFRP hoop wrapping can inhibit local buckling of the steel tube while longitudinal wrapping inhibits bending. GFRP strengthening can also improve the initial strength of the composite column.

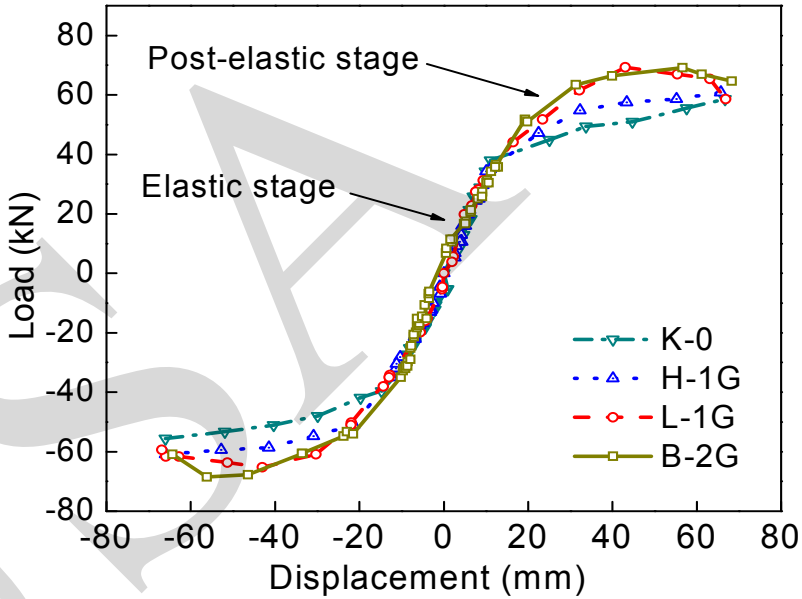

Fig.7 Skeleton curves for different FRP wrapping modes

Table 3 Energy dissipation capacity for GFRP strengthened CFT

Serial number	*E*	Improvement (%)
K-0	2.23	
H	2.29	2.7
L	2.47	10.8
B	2.61	17.0

2. The normalized energy dissipation coefficients for specimens with circumferential, longitudinal, and bi-direction GFRPs improve by 2.7%, 10.8% and 17.0%, respectively.

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3. As the GFRP thickness increases, the ultimate bearing capacity and skeleton curve tangential stiffness for the post-plastic stage improve linearly

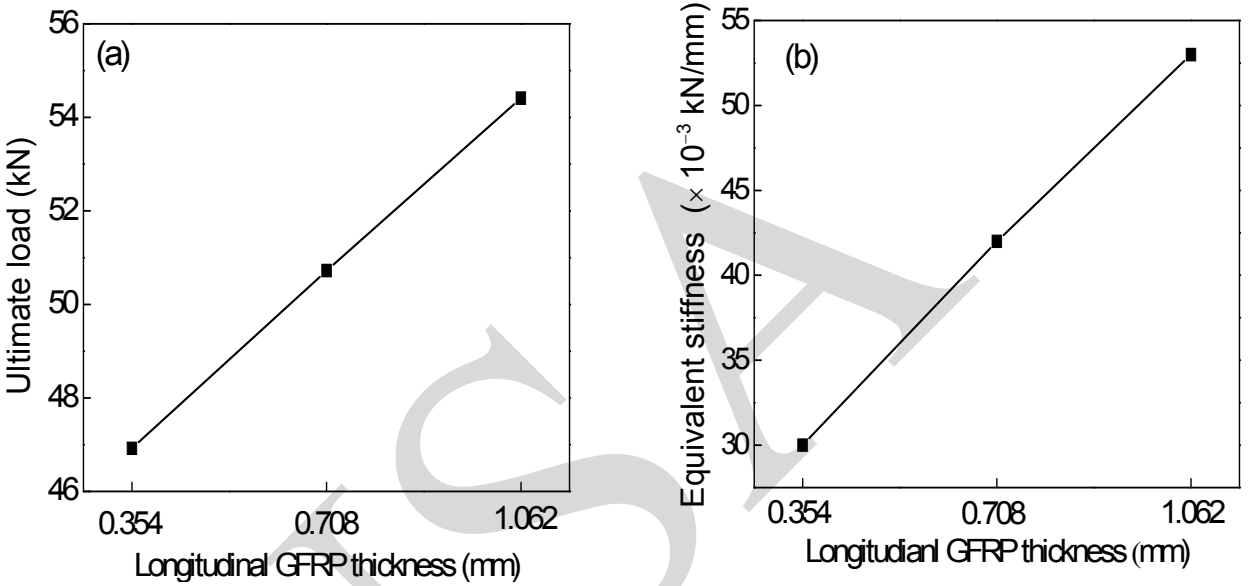

Fig. 13 GFRP layers-ultimate load (a) and GFRP layers-equivalent stiffness (b) relationships

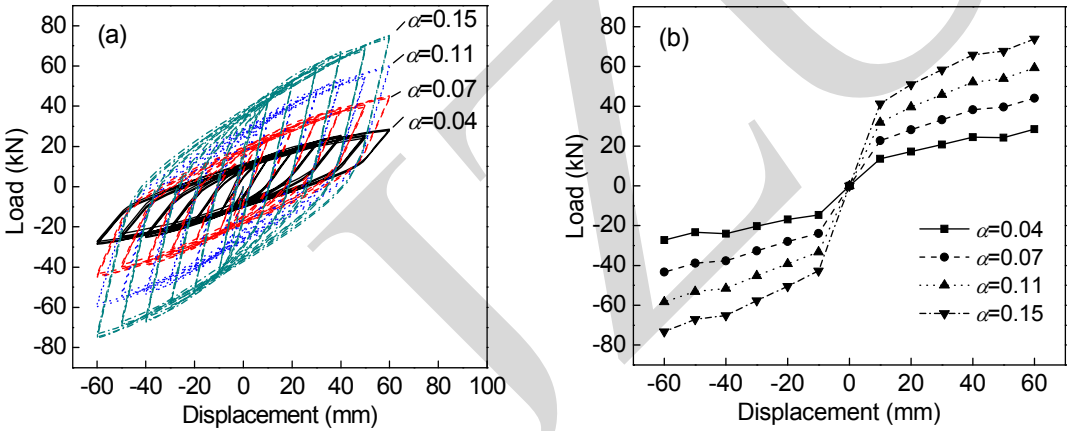

Fig. 16 Hysteresis (a) and skeleton (b) curves with different steel rates of L-1G

4. Post-elastic stiffness and post-strength degrade with the increase of the axial pressure rate; The higher the steel rate, the more energy dissipation capacity the structure has.

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