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1．主な研究概要

① NUMERICAL MODEL FOR 3D STEEL MOMENT FRAMES（立体骨組の数値解析モデル）

Most previous studies only considered the behavior of steel moment frames under unidirectional ground motions. Additionally, the numerical models of most previous studies considered the behavior of only beams and columns, and ignored the behavior of the panel zone of the beam–column connection.

Our research proposes a novel numerical model for studying steel moment frames under multi-directional loadings to consider the 3D elastoplastic behavior of beams and columns, as well as panels. The proposed numerical model was validated by analyzing cruciform subassemblies of beams, columns, and panels, and the analysis results were compared to the experimental results from previous studies. The results of the proposed numerical model corresponded well with the respective test results.

② REQUIRED COLUMN OVERDESIGN FACTOR OF 3D STEEL MOMENT FRAMES（鋼構造立体骨組の必要柱梁耐力比）

Steel moment frames are designed to ensure sufficient energy absorption capacity by achieving an entire beam-hinging collapse mechanism under severe earthquakes. Therefore, the column overdesign factor is stipulated in seismic design codes. Since square tube columns are often used for steel structure buildings in Japan, the two orthogonal planes of the structure are both designed as moment resisting frames. Considering the effect of bi-direction ground motions on the steel moment frames, the specified column overdesign factor is 1.5 or more in Japanese seismic design code. However, the required column overdesign factor of steel moment frames is obtained from analysis results conducted under unidirectional ground motions.

Our research describes the results of the earthquake response analysis of 3D steel moment frames, and presents seismic demand for the column overdesign factor, depending on input direction and amplitude of the ground motion and width-thickness ratio of columns, required to keep the damage below the limit of plastic deformation of square tube columns.

③ SEISMIC STRUCTURAL REINFORCEMENT IN DEVELOPING COUNTRIES（発展途上国での耐震補強）

In Japan, retrofit method with steel brace frame for RC structure are always used. Retrofitting with steel braced frame a lot of studs and anchor bolts are required to fix the steel frame and transmit the tensile stress of diagonal brace to the existing RC frame. However, this method needs heavy equipment and it is difficult to use particularly in rural area, constricted area or remote island.

For seismic retrofitting in the areas mentioned above, we have been developed a new seismic retrofitting method by using CFST (concrete-filled steel tubular) diagonal brace which act only compression, and propose a new hybrid pre-cast member composed of steel tube, cement grout and wood (WGFST) to satisfy the requests from developing area.

2．キーワード

英文：3D steel moment frame; square hollow-section column; panel zone of beam–column connection; time-history response analysis; multi-directional ground motion; numerical model; multi-spring model; Composite members; Seismic retrofit; Brace member; CFST.

和文：立体骨組、角形鋼管、接合部パネル、時刻歴応答解析、多方向入力地震動、数値解析モデル、マルチスプリング、合成部材、耐震補強、耐震ブレース、充填鋼管

3．特色・研究成果・今後の展望

We analyze the behavior of structures through loading experiments and numerical analysis to create better design methods and seismic resistance methods. We are also planning to develop construction method with good efficiency.

researchmap：https://researchmap.jp/dlucifer6

4．社会実装への展望・企業へのメッセージ

For the future 100 years from now, I want to work together to create design and construction methods that I haven't seen yet.