論文 / 著書情報
Article / Book Information

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（博士課程）
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論 文 要 旨

THESIS SUMMARY

専攻： Department of	土木工学　専攻	申請学位（専攻分野）： Academic Degree Requested	博士（学術） Doctor of
学生氏名： Student's Name	SINSAMUTPADUNG NATDANAI	指導教員（主）： Academic Supervisor(main)	佐々木　栄一
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Low-cycle fatigue cracks can initiate from beam-to-column connection in steel bridge piers due to plastic strain caused by earthquake loading as observed in the past earthquakes. These cracks could propagate up to a critical crack length and resulted in failure (i.e., brittle fracture failure or load-bearing failure). Since low-cycle fatigue behavior is governed by the local area behavior, the effective notch strain concept capable for local strain assessment and related to design process is used in the present study to investigate the local strain behavior during earthquakes. The results indicated that steel bridge piers could suffer from large-plastic-strain, high strain rate, and variable-strain patterns. However, the influence of these parameters on low-cycle fatigue behavior of steel member under earthquake loading still remains unclear. The purpose of this research is to investigate the low-cycle fatigue behavior of steel member in large plastic strain region under earthquake loading.

Local strain behavior during earthquakes is investigated based on the effective notch strain concept, using finite element models of steel bridge piers subjected to ground excitation. Local strain behavior including the effective notch strain range, strain rate, and plastic strain history have been clarified for interpreting the severity of low-cycle fatigue damage and defining the scope of investigation in the present study. The cumulative density function (CDF) of the effective notch strain range is obtained, which is used to generate the loading range for the experimental study.

The effect of dynamic strain on low-cycle fatigue behavior of structural steel under large plastic strain during earthquakes is investigated. Low-cycle fatigue tests were conducted using compact-tension specimens with an effective notch shape at various strain rate levels. Based on crack size, it is observed that higher strain rate cause lower fatigue life in large plastic strain region. The energy approach is employed to elucidate the low-cycle fatigue mechanism in this region. A prediction method for the fatigue life considering dynamic strain effect in large plastic strain region is proposed.

The effect of variable strain patterns on low-cycle fatigue behavior of structural steel under large plastic strain during earthquakes is investigated. Low-cycle fatigue tests were conducted using compact-tension specimens with an effective notch shape under various strain patterns. The linear cumulative index combined with the effective notch strain range is found to be applicable for fatigue strength assessment of structural steel under variable strain patterns.

The effect of earthquake loading on low-cycle fatigue behavior of steel welded joint under large plastic strain is investigated. Low-cycle fatigue tests were conducted using load-carrying cruciform joint specimens under earthquake loading. In order to simulate the earthquake loading pattern to be used in the experiment, loading range were obtained from the CDF of the effective notch strain range. The applicability of the linear cumulative index combined with the effective notch strain range has been verified for fatigue strength assessment of steel welded joint under earthquake loading. Moreover, the effect of dynamic strain on low-cycle fatigue behavior of steel welded joint is investigated using low-cycle fatigue tests at various loading rates.

Since the effective notch strain concept has been used for modeling the steel welded joint, the local constraint of the joint has been removed. As a result, a lower strain range than the actual strain condition is obtained. To mitigate this, a modification factor for the effective notch strain range has been proposed in order to determine the actual strain condition. This allows the use of a single curve to predict fatigue life of both the structural steel and the steel welded joint. Hence, a fatigue strength assessment of steel member under earthquake loading can be performed using one unique curve based on the modified effective notch strain range.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。
Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).