

Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH
Kongressbericht

Band: 13 (1988)

Artikel: Full scale test of transmission towers: damping characteristics

Autor: Fukasawa, Takashi / Hiroki, Teruo / Yamagishi, Hirotoshi

DOI: <https://doi.org/10.5169/seals-13159>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. [Siehe Rechtliche Hinweise.](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. [Voir Informations légales.](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. [See Legal notice.](#)

Download PDF: 17.05.2025

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>



Full Scale Test of Transmission Towers: Damping Characteristics

Détermination des caractéristiques d'amortissement de pylônes à haute tension à l'aide d'essais

Grossversuch zur Bestimmung des Dämpfungsverhaltens von Hochspannungsmasten

Takashi FUKASAWA
Tomoegumi Iron Works
Tokyo, Japan

Teruo HIROKI
Tomoegumi Iron Works
Tokyo, Japan

Hirotoishi YAMAGISHI
Tokyo Electric Power Company
Tokyo, Japan

1. INTRODUCTION

This study quantitatively clarifies how the slip deflections of the bolted joints contribute to the damping characteristics through the static loading tests, the free vibration tests and the numerical analyses of two full scale towers shown in Fig.3.

2. EXPERIMENTAL RESULTS

The following items were drawn from the experiments.

2.1 Load-Deflection Characteristics in the Static Loading Tests

-It was proved that the characteristics of the tower could be calculated by the sum of characteristics of the elements such as the members and the bolted joints shown in Eq.(1), Fig.1.

$$\delta = \sum [\bar{N} (NL/EA + \delta_s)] \quad (1)$$

2.2 Damping Ratios in the First Natural Free Vibration Tests

-It was clarified that the damping ratios in the large amplitude were greater than 3% as shown in Fig.2.

-The damping ratios were conducted from the load-deflection characteristics of the towers as shown in Eq.(2).

$$h = 1/2\pi \cdot \ln [(W_m + W_j)/W_m] + 0.005 \quad (2)$$

$$W_m = 1/2 \cdot \sum (N^2 L / EA), W_j = \sum (N_s \delta_s)$$

-The gradual decreased amplitudes in free vibration test can obtain the vibration characteristics such as the damping ratios and the periods consecutively.

3. ANALYTICAL RESULTS

The following items were drawn from the non-linear response analyses.

-The accuracy of the dynamic response analytical method incorporated with non-linear spring elements having the simplified slip characteristics of the bolted joints was proved by comparing with the free vibration tests as shown in Fig.2.

-The non-linear responses by the damping ratios varied according to amplitudes were compared with the linear seismic responses by the fixed equivalent damping ratios. And it was clarified that the equivalent damping ratios in the great earthquakes exceeding 200 gal were greater than 1.5%.

4.CONCLUSION

We are now pushing on normalization of the aseismic design method with combination of these seismic design data and the dynamic response analyses.

P(ton)

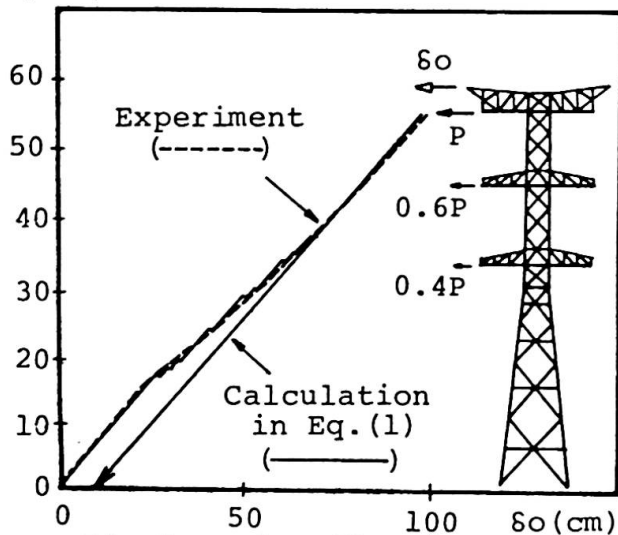


Fig.1 Load-Deflection Relationships

Damping Ratio (%)

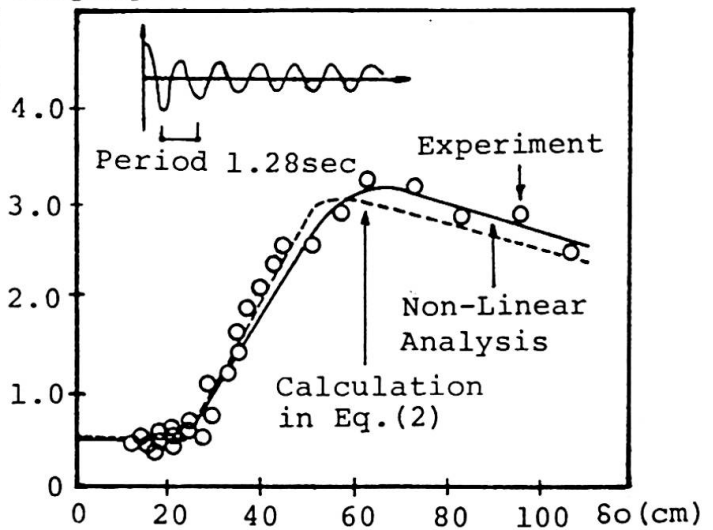


Fig.2 Damping Ratio -Deflection Relationships

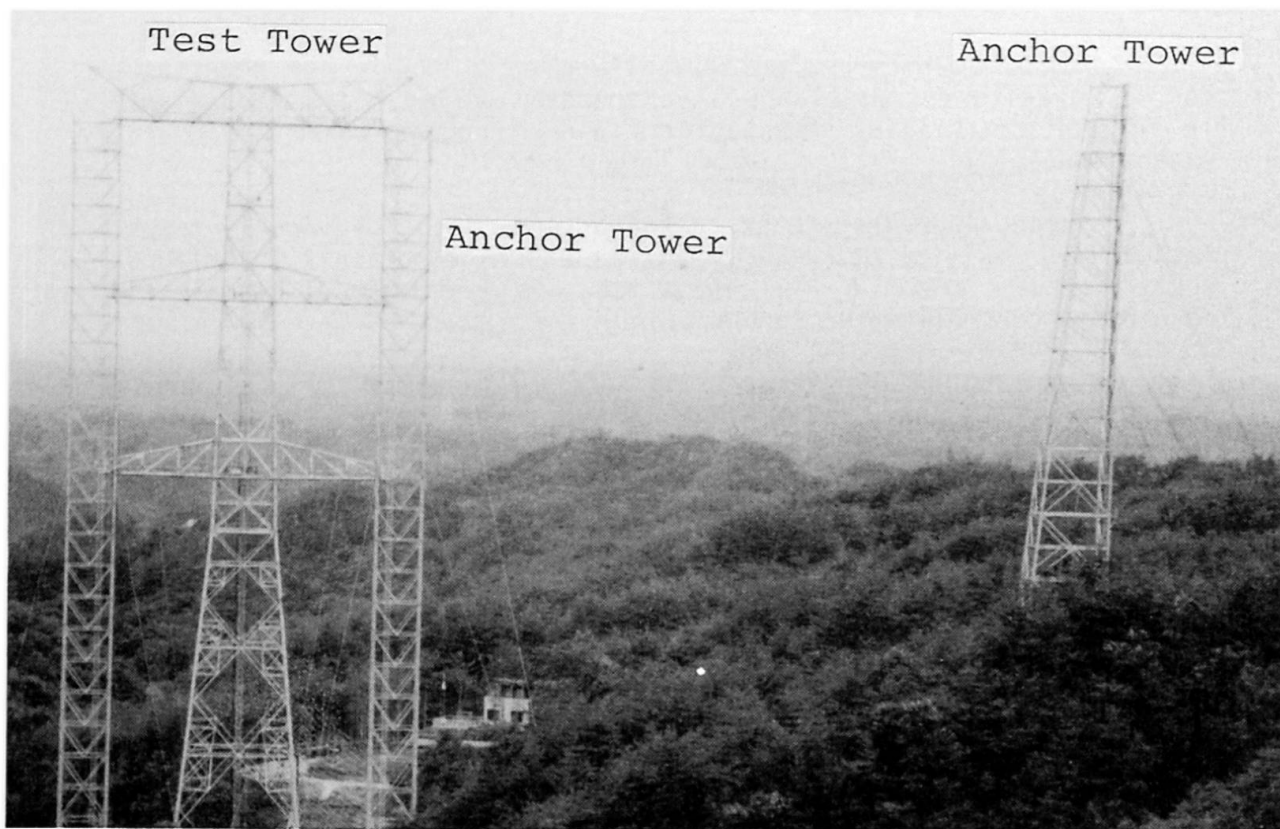


Fig.3 View of Experimental Plant