

社会基盤施設の耐震性向上に関する研究



氏名： 松本 将之 / MATSUMOTO Masayuki E-mail: matsumoto-m@t.kagawa-nct.ac.jp

職名： 助教 学位： 博士(工学)

所属学会・協会： 土木学会

キーワード： 地震工学, 耐震工学, 社会基盤施設, 耐震性評価, 耐震・制震技術, 耐震性向上

技術相談
提供可能技術：
 ・固有値解析, 及び動的応答解析に基づく社会基盤施設の耐震性評価
 ・耐震技術, 及び制震技術を活用した土木建造物の耐震性向上対策

研究内容： 制震装置の適用による付加減衰に基づく送電鉄塔の耐震性向上に関する基礎的研究

我が国では、兵庫県南部地震や東北地方太平洋沖地震、熊本地震等、大規模地震による送電鉄塔の地震被害が多発しており、今後の電力の安定供給のため、鉄塔の耐震性確保は重要課題である。これまでに、送電施設の設計基準は、風荷重や着氷雪荷重に基づく耐風性能向上に関する諸検討がなされており、今後は、検討事例の少ない地震被害を踏まえた耐震性能向上の検討が必要となる。

本研究では、鉄塔の地震に対する安全性確保、及び耐震性向上を図るため、我が国の現行の電力網で基幹線に位置する鉄塔を対象とし、過去の大規模地震に対する耐震性評価、及び耐震性向上のための解析的検討を行っている。鉄塔と地震動の共振現象に対し、同調質量ダンパー (Tuned Mass Damper, 以下、TMD と称す) を活用する方法で鉄塔の減衰化を図り、耐震性向上対策を検討している (図-1)。

鉄塔へTMDを設置することにより、鉄塔の応答が一定の応答低減効果を示すことを確認した (図-2)。また、制震効果を効率的に高める方法として、TMDの設置条件や性能条件を検討することの有効性について示した (図-3)。

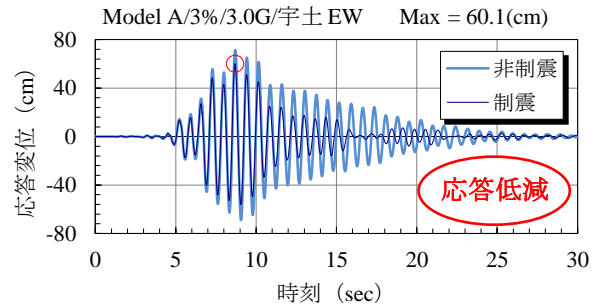


図-2 鉄塔頂部の応答変位

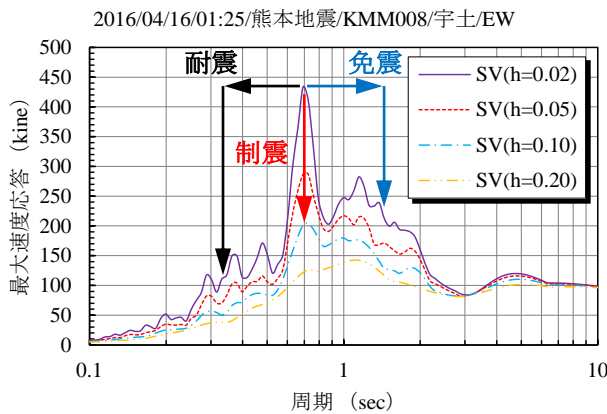


図-1 地震動の速度応答スペクトル

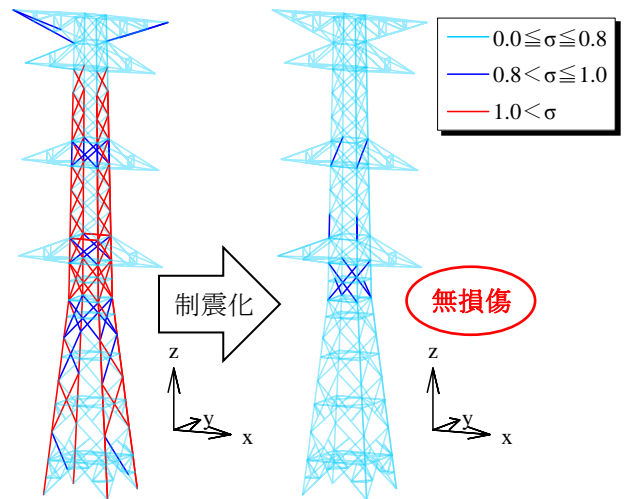


図-3 鉄塔部材の無次元化軸力

提供可能な設備・機器：

名称・型番(メーカー)	

Study on Improving Seismic Performance of Social Infrastructures



Name	MATSUMOTO Masayuki	E-mail	matsumoto-m@t.kagawa-nct.ac.jp
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Status	Assistant Professor
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Affiliations	Japan Society of Civil Engineers
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Keywords	Earthquake engineering, Seismic engineering, Social infrastructure facilities, Seismic evaluation, Seismic control technology, Improving seismic performance
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Technical Support Skills	<ul style="list-style-type: none"> • Seismic evaluation of infrastructures based on eigenvalue analysis and dynamic response analysis • Methods for improving seismic behavior of structures using seismic control technology
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Research Contents

Fundamental Study on Improvement of Seismic Performance of Transmission Tower Based on Additional Damping by Using the Damping Device

In Japan, earthquake damages of power transmission towers caused by large-scale earthquakes such as the Southern Hyogo Prefecture Earthquake, the Tohoku-Pacific Ocean Earthquake, and the Kumamoto Earthquake have occurred frequently. Therefore, securing the earthquake resistance of the towers is an important issue for the stable supply of power in the future. The design standards for power transmission facilities have been studied for improving wind resistance by wind load and icing snow load. In the future, it will be necessary to study the improvement of seismic performance based on the earthquake damage with few examples.

In this study, in order to ensure the safety of towers against earthquakes and to improve the earthquake resistance, the towers on the main line in the power grid in Japan are targeted. And this research is an analytical study to evaluate the seismic performance and to improve the seismic behavior by past large-scale earthquakes. In this consideration, the tower is damped by using a tuned mass damper (hereinafter referred to as TMD) for the resonance phenomenon between the tower and the seismic wave (Fig-1).

It was confirmed that by attaching TMD to the steel tower, the response of the tower showed a certain effect of response reduction (Fig-2). In this study, the effectiveness of changing the installation conditions of the damper was shown as a method to improve the seismic effect by TMD (Fig-3).

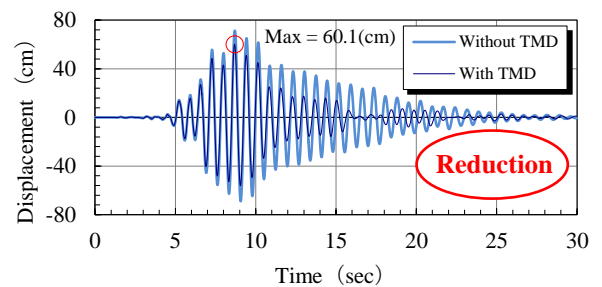


Fig-2 Response displacement at the top of steel tower

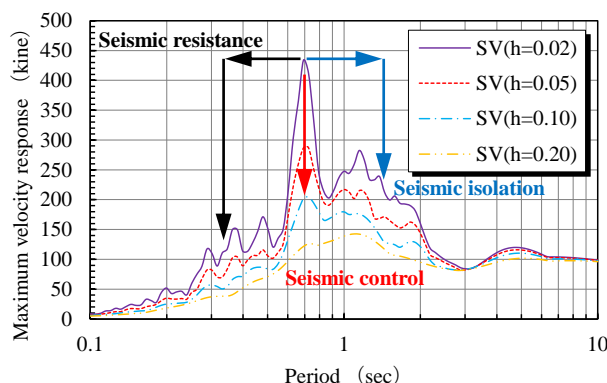


Fig-1 Velocity response spectrum of seismic wave

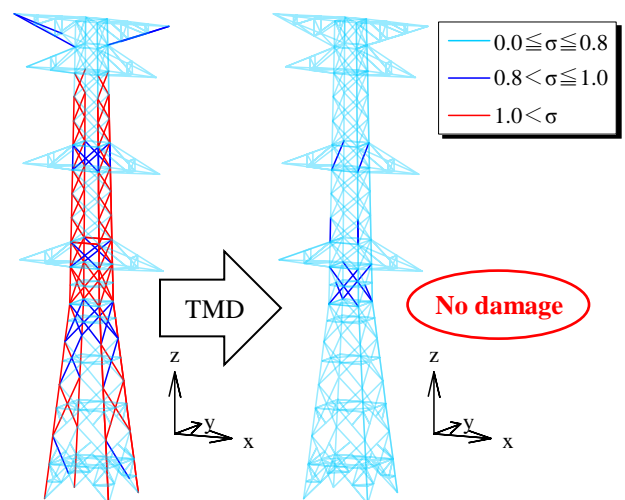


Fig-3 Non-dimensional axial force of steel tower's members

Available Facilities and Equipment
