中国电机工程学报 2010, 30(32) 84-90 DOI: ISSN: 0258-8013 CN: 11-2107/TM

动力机械与工程

短路故障时汽轮发电机组轴系弯扭耦合振动分析

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摘要： 简要介绍了用于分析机组弯扭耦合振动的增量传递矩阵方法，利用该方法，分析了发电机出口端两相短路和三相短路故障时轴系弯扭耦合振动特性，并与三相短路重合闸以及非同期并网故障的耦合振动特性进行了比较。分析表明：发电机出口端发生短路故障时，各转子都很快被激励出扭振来，由于耦合作用，各转子弯振也发生一定的变化，但弯振的变化明显滞后于扭振；弯振受短路故障影响较为明显；各转子扭角与扭矩变化特征相似，其频率成分包含了工倍频及前三阶扭振固有频率；各种电气故障下，各转子弯振幅值都增大了，发电机转子增加最为明显；三相短路及重合闸故障不论是对高、中、低压转子，还是对发电机转子的弯振、扭振以及扭矩幅值影响都最为显著。

关键词： 短路故障 弯扭耦合振动 增量传递矩阵法 汽轮发电机组

Coupled Flexural and Torsional Vibrations Analysis of Turbine Generator Shaft Systems Caused by Short Circuit Fault

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Abstract:

The increment transfer matrix method used for calculating the responses of coupled flexural and torsional vibrations was introduced in this paper. The responses properties of coupled vibrations caused by two phase or three phase short circuit fault near generator export terminal were analyzed. The analyzed results were compared with the vibration properties caused by three-phase short-circuit and auto-reclosure fault and asynchronous juxtaposition fault. The results show that torsional vibrations of every rotor are excited rapidly when short circuit fault near generator export terminal happens. Correspondingly, flexural vibrations of every rotor change a litter. The changes of flexural vibration are lag to that of torsion obviously. Flexural vibration is affected by short circuit fault visibly. The characteristics of torsional angle and torsional moment of every rotor are similar, which frequency components contain former three steps inherence frequency and working frequency of torsion mainly. For five electric faults, the amplitudes of flexural vibrations add up, and the amplitude increment of generator rotor is the most obvious. When three-phase short-circuit and auto-reclosure fault happened, the amplitudes of flexural vibration, torsion and torsional moment for not only high-pressure, middle-pressure and low-pressure rotors but also generator rotor are the most obvious.

Keywords: short circuit fault coupled flexural and torsional vibrations increment transfer matrix method turbo-generator unit

收稿日期 2010-06-21 修回日期 2010-07-08 网络版发布日期 2010-11-25

DOI:

基金项目:

国家自然科学基金项目(50905058)；中央高校基本科研业务费专项资金(10MG14)。

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