THREE PHASE STATE ESTIMATION TECHNIQUES FOR NETWORK VOLTAGE UNBALANCE ASSESSMENT

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DECLARATION OF THE CANDIDATE & SUPERVISOR

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DEDICATION

To my parents for earning an honest living and for supporting and encouraging me to believe in myself. I dedicate this thesis to my family for nursing me with affections and love and their dedicated partnership for success in my life.

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ABSTRACT

Voltage unbalance is an important aspect of power quality. Unbalance can damage power equipment in a power system network, affect the operation of sensitive customer equipment and increase losses. Conventional Power system state estimation (PSSE) which assumes the network to be fully balanced does not capture the information related network voltage unbalance. Although, the single line representation of the network is good enough for most of the cases when it comes to transmission level, there can be certain locations in the power system, especially in the distribution network, which are prone to high voltage unbalance (VU) levels over which network operators wish to have full three-phase details in real time. To address this issue, completely switching into three phase model of the network which will add a significant computational burden, is not a feasible solution at all.

As a feasible remedy, this thesis introduces a novel methodology for voltage unbalance state estimation extending the conventional state estimation which can be selectively applied only for the locations of interest to capture the information related to network voltage unbalance, with minimum additional computational effort. The proposed three phase estate estimation make use of Singular Value Decomposition method to work out the estimation of three phase voltages and hence the complex voltage unbalance factor (VUF) at the locations of interest.

Proposed methodology is verified using IEEE 4 bus and 14 bus test networks simulating them using a three phase unbalanced power flow program written in MATLAB environment.

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LIST OF ABBREVIATIONS

Abbreviation	Description
VU	Voltage Unbalance
SE	State Estimation
SVD	Singular value decomposition
DSSE	Distribution System State Estimation
VUSE	Voltage Unbalance State Estimation