

Application of Universal Distribution Factors for Real-Time Complex Power Flow Calculation

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Abstract : Complex power flow distribution factors, which relate line complex power flows to the bus injected complex powers, have been widely used in various power system planning and analysis studies. In particular, AC distribution factors have been used extensively in the recent power and energy pricing studies in free electricity market field. As was demonstrated in the existing literature, many of the electricity market related costing studies rely on the use of the distribution factors. These known distribution factors, whether the injection shift factors (ISF's) or power transfer distribution factors (PTDF's), are linear approximations of the first order sensitivities of the active power flows with respect to various variables. This paper presents a novel model for evaluating the universal distribution factors (UDF's), which are appropriate for an extensive range of power systems analysis and free electricity market studies. These distribution factors are used for the calculations of lines complex power flows and its independent of bus power injections, they are compact matrix-form expressions with total flexibility in determining the position on the line at which line flows are measured. The proposed approach was tested on IEEE 9-Bus system. Numerical results demonstrate that the proposed approach is very accurate compared with exact method.

Keywords : distribution factors, power system, sensitivity factors, electricity market

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