

# SIMULATION OF THE PARALLEL CONNECTION OF ELECTRICAL POWER STATIONS

I. ÇOLAK, E. N. YILMAZ

Gazi University, Technical Education Faculty, Ankara-TURKEY

## Abstract

Experimental analysis of the parallel connection of any local power station to an infinite bus and problems occurred before and after the connection may be very expensive and complicated at some laboratory conditions. In this study, the parallel connection of a local power station to an infinite bus has been modelled and simulated by using DELPHI packet program. The study is focused on the immediate finding and solution of the occurred problem with the aid of a computer. Visualisation capability of DELPHI makes the program to be used for educational purposes at undergraduate level.

## 1. Introduction

The parallel connection of two or more power stations either to each other or to an infinite bus is required to feed the increased load. The parallel connection of two power stations requires following conditions to be achieved:

- equality of the frequencies
- equality of the output voltages
- same phase orders
- zero phase angle between the same phases

The infinite bus has its own protection. Although private power stations have been included into the infinite bus, they have separate protection as well. Otherwise, the problems occurred in private power stations, such as over current, over/low voltage, over/low frequency, power-island, reverse power flow, potential difference between neutral and earth lines, affect the infinite bus.

To prevent power stations, some rules have been proposed. One of them is that, all the power stations being connected in parallel must have their own protection and control systems. There are some attempts have been made to control the system such as mechanical or electronics control, which are now not enough. But controlling the system with a computer can solve many problems very quickly and visualise them at the same time. In case of lack of equipment for experimental study of parallel connection at undergraduate level in laboratory condition, this simulation program can be cheap and used for teaching purposes.

## 2. Control of Private Power Station

When small private power station is being connected to an infinite bus, a manual control is generally used. Because of the manual control is not accurate, there are some problem mentioned above occur during this connection. Therefore, small private power station is not allowed to be connected to any infinite bus manually [1]. For a parallel connection, there are some devices used such as measurement devices, breakers, disconnecters, synchronoscope and other parallel connecting test equipment.