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Abstract

Degradation of PV modules can cause excessive overheating which results in a reduced power output and eventually failure of solar panel. To maintain the long term reliability of solar modules and maximize the power output, faults in modules need to be diagnosed at an early stage. This paper provides a comprehensive algorithm for fault diagnosis in solar modules using infrared thermography. Infrared Thermography (IRT) is a reliable, non-destructive, fast and cost effective technique which is widely used to identify where and how faults occurred in an electrical installation. Infrared images were used for condition monitoring of solar modules and fuzzy logic have been used to incorporate intelligent classification of faults. An automatic approach has been suggested for fault detection, classification and analysis. IR images were acquired using an IR camera. To have an estimation of thermal condition of PV module, the faulty panel images were compared to a healthy PV module thermal image. A fuzzy rule-base was used to classify faults automatically. Maintenance actions have been advised based on type of faults.

Key words— Infrared thermography, fault diagnosis, PV module, thermal signatures

I. Introduction

As the concern for climate change is increasing, the world is looking more toward clean energy resources. In this scenario, solar energy has been emerged as a major non-polluting and ever-lasting source of energy. In last decade, solar energy installations have registered an exponential growth [1]. Amid growing dependence of world over on solar energy, it is natural concern of researchers and engineers to provide reliable and long-lasting solar energy production systems [2]. Since the life-time of a solar module is for long term (25-30 years), hence to have maximum output from the solar modules it is necessary to have regular maintenance of solar energy production systems. Moreover fault diagnosis is necessary to have uninterruptable power supply and to avoid solar power plant shutdowns.

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