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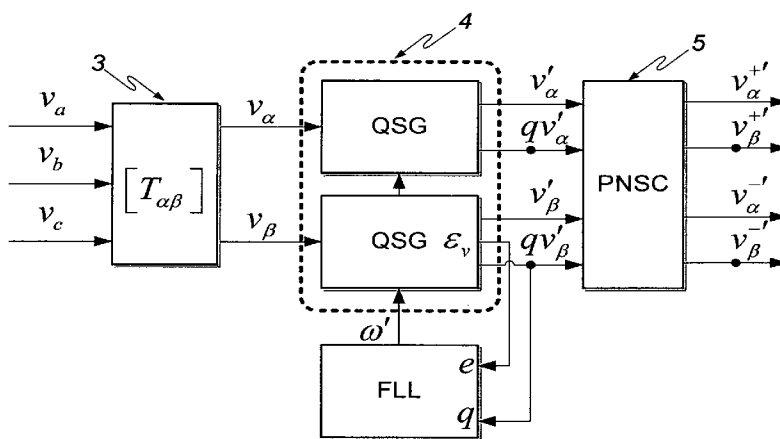
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(54) Title: ADVANCED REAL-TIME GRID MONITORING SYSTEM AND METHOD



(57) Abstract: This invention deals with an advanced Real-time Grid Monitoring System (RTGMS) suitable for both single-phase and three-phase electric power systems. This invention provides an essential signal processing block to be used as a part of complex systems either focused on supervising and diagnosing power systems or devoted to control power processors interacting with the grid. This invention is based on a new algorithm very suitable for real-time characterization of the grid variables under distorted and unbalanced grid conditions. The main characteristic of this invention is the usage of a frequency-locked loop, based on detecting the grid frequency, for synchronizing to the grid variables. It results in a very robust system response in relation to existing technique based on the phase-angle detection since grid frequency is much more stable variable than the grid voltage/current phase-angle, mainly during grid faults. Moreover, the algorithm supporting this invention is very efficient and can be implemented in regular industrial microprocessors. These features make the RTGMS object of this invention ideal to be applied in the control of distributed generation systems (DGS), flexible AC transmission systems (FACTS), power quality conditioners (PQC) and uninterruptible power supplies (UPS). In all these systems, the fast and precise real-time detection of the voltage and/or current sequence components under grid fault conditions is a crucial matter.

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INTERNATIONAL SEARCH REPORT

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>RODRIGUEZ P ET AL: "New Positive-sequence Voltage Detector for Grid Synchronization of Power Converters under Faulty Grid Conditions" POWER ELECTRONICS SPECIALISTS CONFERENCE, 2006. PESC '06. 37TH IEEE JEJU, KOREA 18-22 JUNE 2006, PISCATAWAY, NJ, USA, IEEE, 18 June 2006 (2006-06-18), pages 1-7, XP010945413 ISBN: 978-0-7803-9716-3 cited in the application page 5 - page 6; figures 3,7</p> <p align="center">----- -/--</p>	1,7

Further documents are listed in the continuation of Box C.

See patent family annex.

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>TIMBUS A V ET AL: "Grid monitoring for distributed power generation systems to comply with grid codes" 2006 IEEE INTERNATIONAL SYMPOSIUM ON INDUSTRIAL ELECTRONICS 9-13 JULY 2006 MONTREAL, QUE., CANADA, 9 July 2006 (2006-07-09), pages 1608-1612, XP009102035 2006 IEEE International Symposium on Industrial Electronics IEEE Piscataway, NJ, USA ISBN: 1-4244-0497-5 the whole document</p>	1,7
A	<p>CATALIOTTI A ET AL: "A new Phase Locked Loop Strategy for Power Quality Instruments Synchronisation" INSTRUMENTATION AND MEASUREMENT TECHNOLOGY CONFERENCE, 2005. IMTC 2005 . PROCEEDINGS OF THE IEEE OTTAWA, ON; CANADA 16-19 MAY 2005, PISCATAWAY, NJ, USA, IEEE, vol. 2, 16 May 2005 (2005-05-16), pages 941-946, XP010900561 ISBN: 978-0-7803-8879-6 the whole document.</p>	1,7
P,X	<p>RODRIGUEZ P ET AL: "Advanced Grid Synchronization System for Power Converters under Unbalanced and Distorted Operating Conditions" IECON 2006. 32ND ANNUAL CONFERENCE ON IEEE INDUSTRIAL ELECTRONICS 6-10 NOV. 2006 PARIS, FRANCE, 6 November 2006 (2006-11-06), pages 5173-5178, XP031077746 IECON 2006. 32nd Annual Conference on IEEE Industrial Electronics (IEEE Cat. No. 06CH37763) IEEE Piscataway, NJ, USA ISBN: 978-1-4244-0390-5 the whole document</p>	1-7
P,A	<p>KRIEGER A W ET AL: "Frequency Locked Phase Estimation" ELECTRICAL AND COMPUTER ENGINEERING, 2007. CCECE 2007. CANADIAN CONFERENCE ON, IEEE, PI, 1 April 2007 (2007-04-01), pages 566-570, XP031110562 ISBN: 978-1-4244-1020-0 the whole document</p>	1,7