Werner Hugo Wölfle was born in Bad Schussenried, Germany. He graduated from the University of Stuttgart in Germany in 1981 as a Diplom-Ingenieur in Electrical Engineering. He completed a PhD degree in Electrical Engineering at the National University of Ireland, Galway in 2003.

He was a lecturer and lead researcher from 1981 to 1982 at the "Institut for Leistungselektronik und Anlagentechnik" at the University of Stuttgart, where he developed the first 20kW switch mode power converter with high voltage bipolar transistor technology for thin blade welding applications.

He worked from 1982 to 1985 for Dornier Systems GmbH, where he adapted this technology for space applications. He was power systems and project manager for the high power conversion and control units for two payload experiments (MEDEA) for the SPACELAB D1 Mission of the European Space Agency (ESA) and he also was the leading design engineer for the primary satellite power system for the X-Ray Observatory Satellite (ROSAT).

From 1986 to 1989 he worked as a Research and Development Manager of industrial AC and DC power converters with Riester GmbH. Since 1989 he is Managing Director and head of the design group of Convertec Ltd. in Ireland. Convertec develops high reliability power converters for industrial applications and renewable energy systems. He has published extensively in the area of Power Electronics

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Inaugural Lecture

Development of an Uninterruptible Emergency Power Supply for Pitch Control Systems for Offshore 5MW Wind Turbines

Speaker Professor Werner Wölfle
Adjunct Professor of Electrical Engineering
Tuesday 30th September, 2008
At 3.30 pm
Siobhán McKenna Lecture Theatre
Arts Millenium Building
Followed by a reception.

NUI Galway Joint Development with Power Industry

Over recent years researchers at the POWER ELECTRONICS RESEARCH CENTRE in NUI Galway developed novel battery charging and monitoring principles with engineers from CONVERTEC LIMITED in Wexford. The newly developed charging algorithm has been validated and implemented into battery backup systems for pitch control systems for wind turbines. The new developments play a distinct role in improving the safe and reliable operation of the propeller pitch control on wind turbines. The overall availability and reliability of whole wind farms has been increased dramatically.

The latest application is in wind turbines presently built and installed at an offshore field in the north sea. The underlying basic physical and electrical principles for the development of the backup power supply for the pitch control for a wind turbine will be presented.

Wind Turbine Introduction

Wind contains kinetic energy, which can be harvested by wind turbines. The wind energy is transferred into electrical energy. The turning speed of the propeller has to be adjusted to actual wind speed for optimum power acquisition. The maximum power of a large state of the art wind turbine is 5MW at present. At such tremendous power availability the operation without load (e.g. mains failure) can accelerate the propeller instantly to such a speed, that the centrifugal forces exceed the material strength of the propeller.

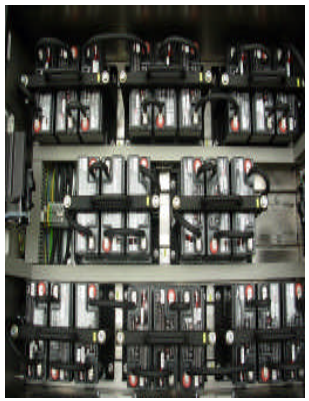
Propeller Pitch Control

The pitch of each of the propellers of the wind turbine is controlled by 15 kW electrical motors and dedicated sets of emergency backup batteries, all placed within the turning hub of the propeller. The blade pitch is controlled in accordance to wind speed and brought to neutral in gale force winds or under no load conditions.

Hub of a 5 MWatt Wind Turbine

Battery Charging & Monitoring

A patented, temperature compensated Intermittent Current Charge Control principle, Self Equalising Interrupted Charge Control (SEICC) is applied to charge the standby backup batteries for the pitch control motors. The battery life span is extended, as the state of health and state of charge of the batteries are properly established by patented pulse measurement methods.



Pitch control battery (assembly of 144 battery cells of 2V/16Ah each)

Power Converter

A switched mode power supply is used to generate the charging current profiles for the backup battery with a driving voltage up to 360VDC. The circuit is based on a fly-back converter with 150kHz switching frequency and a power conversion efficiency over 90%. The battery is fully isolated from the mains supply and the charging process is controlled by a microcontroller, which also provides monitoring of the state of the battery during charge, standby and load conditions.

Harmonic frequencies of the fundamental switching frequency are created by the switch mode power supply. The effects of slope shaping with regard to current- and voltage pulses are vital for low electromagnetic conducted and radiated emissions.

Commercial Aspects

The investment related depreciation for a wind turbine; the maintenance and repair costs and the average wind speed define the net revenue of the wind turbine. Unnecessary downtime of the turbine quickly translates into a loss making situation.

Micro-Processor controlling 144 battery cells using the newly developed SEICC regime

Future Outlook

Joint applications of solar cells, ultracapacitors (supercapacitors), and batteries in connection with high power pulse loads will be discussed.

Reliability decides if money is in the air!

Places are limited and must be booked in advance. Please send your name and details to Sara Armstrong by September 23rd, 2008
Email: sarmstrong@nuigalway.ie
Telephone: 091 493270
Directions: Enter via Distillery Road at AIB Bank, pay and display parking is available near the University Chapel (first right).
Head towards the Campus and the Arts Millennium Building is on your right.