Stellenbosch UNIVERSITY IYUNIVESITHI UNIVERSITEIT

ENGINEERING
EYOBUNJINELI
INGENIEURSWESE

Prof Johan van der Spuy

sjvdspuy@sun.ac.za

- **Research Field**
  Turbomachinery
- **General Description of Research Field**
  1) The use of direct dry-cooling in power generation systems is a means of ensuring sustainable water usage. The efficient, low noise, operation of the axial flow fans that form part of such an air-cooled system is essential for a well-performing system. These research topics (topics 1, 2 and 3) focus on the design, testing and analysis of axial flow fans for these systems. 2) The use of micro gas turbines (MGTs) for the propulsion of aerial vehicles or solar thermal power applications hold specific advantages. The topic is related to the development of a turboshaft micro gas turbine.

Topics	MEng Struct	MEng Resrch	PhD	Potential Funding
Reducing the noise signature of a large diameter axial flow cooling fan. Existing work has focused on the measurement and modelling of the noise emitted by a large diameter cooling fan. This project will now attempt to reduce the noise characteristics of such a fan by altering the blade configuration of the fan, without replacing the fan blades. Modifications must therefore be made in the form of attachments added to the fan blade. The work will involve intensive experimental evaluation, as well as numerical modelling of the flow around the fan blades. **Requirements:** CFD	✓	✓		
The development of a 30 kW turboshaft micro gas turbine. An existing project has developed the methodology for the design of a 30 kW turboshaft micro gas turbine. This project will con- tinue this work by developing an actual gas turbine engine. Once completed, the engine will be tested and its performance verified. **Requirements:** CFD, thermofluids 344		✓		
Measuring the performance of the 24 ft. installed MinwaterCSP axial flow fan. The project will specifically focus on modelling and accurately measuring the performance of the 24 ft MinwaterCSP axial flow fan. Existing work has focused on the measurement and modelling of this fan's performance under stable conditions. The idea is to expand this work in order to monitor the fan's performance under varying atmospheric conditions. These will be correlated to existing CFD models of the fan and expanded to correlate with the effect of variable atmospheric conditions. **Requirements:** CFD		✓	✓	✓

Topics	MEng Struct	MEng Resrch	PhD	Potential Funding
Design and develop a gas generator and impulse turbine for the SAFFIRE Rocket Engine Pumps Collaborative Project with UKZN Aerospace Systems Research Institute UKZN Contact: Prof G Snedden The gas generator will run on LOX and Kerosene and must generate 85kW at between 20000 and 33500 RPM. Provision must be made for material limitations in so far as the available materials and manufacturing techniques in South Africa. Axial thrust imbal- ance between the pumps amounts to as much as 12kN and this must also be accommodated in the system design. **Requirements:** CFD, turbomachinery		✓		✓
Sudden expansion pressure loss and recovery in fans Collaborative Project with UKZN UKZN Contact: Prof G Snedden In ventilation fans the fan blading sits in an annulus with the hub forming a barrel inside a duct. Once the motor barrel terminates there is effectively a sudden expansion of an annulus into a duct. The frictionless Carnot-Borda assumption is often used to account for losses and the static pressure recovery in this sudden expansion, however Carnot-Borda was intended for small to large pipe sudden expansions and is, as stated, frictionless. The aim of this work is to develop a validated correlation for the losses in fan arrangement. This correlation should account for variation in: • Fan velocity • Duct diameter ratio • Changes in inlet swirl • Changes in hub to tip velocity profile Note: Funding from Industry partners/THRIP to be applied for but not yet assured. **Requirements:** CFD		✓		✓
CFD Analysis and Optimization of a Truck Body One of the key strategic goals in the truck manufacturing industry today is to reduce emissions. One way of doing this is to improve the aerodynamic performance of the truck. This topic will be completed in conjunction with an industry partner. The goal is to make use of CFD analysis and optimization to improve the aerodynamic performance of a new truck design. The project is open ended in the sense that any modifications to the current design that will improve the aerodynamic performance can be considered. However, all modifications have to satisfy a number of constraints, for example the interior space requirements for the cab, the engine compartment, etc. Modifications will thus be limited to the truck body only. The student will be using CFD and numerical design optimization extensively. The project is funded with a full bursary and will be co-supervised by Prof Gerhard Venter. The student will be exposed to interaction with the industry partner's engineers and would most probably spend some time at the engineering company to get up to speed with their current design procedures. **Requirements:** CFD		✓		✓