

Graduate Studies Program:
Academic Year 2014 - 15

**"Renewable Energy Systems: Design,
Development and Optimization"**

Supervisor's Name: Dr Dimitrios Sagris

Subject:

Parametric design and evaluation of parabolic solar collectors for residence application

Introduction & Motivation:

Solar collectors are widely used in residences worldwide. The proposed thesis investigates the design and performance optimization of a solar collector using parabolic reflector. The goal of the thesis is to investigate the use of parabolic solar collectors for residences application, by means of thermal analysis on a rotating structure, automatically controlled by a real-time sun location detector. The investigation will include the most common materials for the collector, solar tracking systems for the automatic control, as well as structural components for the design, focused on an optimum balance of performance and cost. An analysis of the thermal performance of the solar collector in relation to structural and automation parameters will be performed, in order to gain useful data for this technology.

Implementation & Means:

- Theoretical analysis of solar collectors and their performance
- Design of 3D parametric model of parabolic solar collector using dedicated software
- CFD computations and parametric analysis of parabolic solar collector thermal performance combined with structural analysis and analysis of control system for optimization of energy absorption and overall collector performance

References:

- [1] Hank Price, Eckhard Lüpfer, David Kearney, Eduardo Zarza, Gilbert Cohen, Randy Gee and Rod Mahoney, J. Sol. Energy Eng. 124(2), pp. 109-125, 2002.
[2] Duffie, J.A., Beckman, W.A., Solar Engineering of Thermal Processes: Fourth Edition, Solar Engineering of Thermal Processes: Fourth Edition, 910 p, 2013.

Requirements: Good knowledge of Heat Transfer, Solar Energy, Computational Mechanics and Computational Fluid Dynamics