NUCL 563
Direct Energy Conversion

Spring, 2024 9 January 2024
Tu/Th 1:30 - 2:45 PM @GRIS 126

Course Objectives: Review energy sources and study the basic processes of direct energy conversion and their applications to energy utilization, based on both conventional and nuclear energy conversion schemes. Conventional schemes include thermoelectric, photovoltaic, thermionic, magneto-hydrodynamic (MHD) generators, fuel cell systems, etc.; and nuclear energy conversion schemes corresponds to nuclear radiation and fusion energy conversions.
Prerequisites: Thermodynamics, fluid mechanics, electromagnetism, and modern physics.

Course Syllabus:

1. Reviews of energy sources and direct energy conversion
2. Uses of energy storage
3. Physical principles (thermodynamics, quantum mechanics, solid state physics, and plasma physics as needed)
4. Thermoelectric generators
5. Photovoltaic generators
6. Thermionic generators
7. Magnetohydrodynamic (MHD) power generator
8. Fuel cell
9. Nuclear energy conversion (radiation and fusion energy conversion)
10. Other direct energy conversion schemes, e.g., electrohydrohynamic (EHD) power generator, piezoelectric power generator, ferroelectric and ferromagnetic power generators, etc.

Textbooks:

R. Decher, Direct Energy Conversion, Oxford Univ. Press (1997).
S. Angrist, *Direct Energy Conversion*, 4/ed., Allyn & Bacon (1982).

References:

1. A. Ghoniem, Energy Conversion Engineering, Cambridge Univ. Press (2022).
2. M. El-Wakil, *Nuclear Energy Conversion*, American Nuclear Society (1982).
3. G. H. Miley, *Fusion Energy Conversion*, American Nuclear Society (1976).
4. M. Prelas, et al., *Nuclear Batteries and Radioisotopes*, Springer Nature/Science (2016).

Instructor: Prof. Chan K. Choi, choi@purdue.edu
Office hours: TuTh 3:00 –4:20 PM @LMBS 5246 or by Appointment

Course Grading: Attendance = 10%; homework = 50%; project report and presentation = 40%
$85\% \leq A \leq 100\%$, $70\% \leq B < 85\%$, $55\% \leq C < 70\%$, $40\% \leq D < 55\%$,
and not passing below 40%; unexcused absences over 2 weeks = not passing.