

**Title:** Artificial neural network-based characterization of nuclear power reactor pressure tube samples.

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Students interested in the project should find a faculty member in Computing to agree to co-supervise the project.

**Context:** There are 18 CANDU reactors in Ontario that provide 60% of its electricity. The reactors' core main structural element is a pressure tube made of a zirconium alloy. Over the decades over which the reactors operate, these zirconium alloys react with water, which leads to the ingress of hydrogen and subsequent formation of zirconium hydrides. These hydrides modify the pressure tubes' mechanical properties and can potentially be responsible for limiting the safe operating life. For this reason, a large number of samples are collected to track the size, distribution and morphology of these hydrides. This includes optical and electron micrographs.

**The research project:** Develop an ANN to automatically identify hydrides in the micrographs, and then correlate the morphology of the hydrides to the sample's prior thermomechanical treatment. We have experience using an existing ANN which was focused on identifying He bubbles in Ni-alloy micrographs; however a significant amount of development will be necessary, given the much more complex morphology of Zr hydrides.