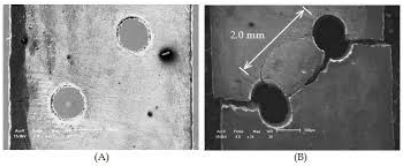
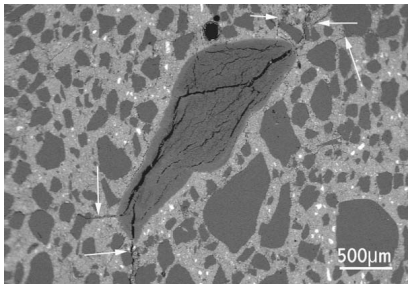
MATHEMATICS REU COURSE: MATH 4800 (class number 10460, 3 credit hours)

AN INVERSE PROBLEM: FINDING BOUNDARY FIELDS WHICH PRODUCE BREAKDOWN





NEW TIME: FALL SEMESTER 2014, Mondays, Wednesdays, Fridays 12.55pm-1.45pm in JWB240

INSTRUCTOR: Distinguished Professor Graeme Milton, email milton@math.utah.edu

DESCRIPTION: This course, suitable to undergraduates interested in applied mathematics, physics, geophysics, or engineering, serves as an introduction to the exciting and important area of inverse problems, where one seeks information as to what is inside a body from measurements at the boundary. This has important applications to engineering, medicine, geophysics, and homeland security. A particular focus of the course will be the problem of determining what boundary fields are necessarily dangerous in the sense that they will cause the material inside the body to break down. Most materials break down if the fields are high enough, this breakdown may be mechanical fracture (cracking) or plastic yielding (for elasticity) or electrical shorting (in dielectric media) and in general one wants to prevent this. It is obviously important to know what boundary conditions necessarily lead to dangerously high internal fields. For a homogeneous body this is straightforward as one could solve for the internal fields, but what if the body is inhomogeneous, say containing two materials (or one material with holes) in an unknown geometry? Here we will explore this question and the ultimate goal of the course will be to produce a scientific paper on the problem, with the class contributing to the research and coauthoring the paper which will then be submitted to a scientific journal.

TUITION BENEFIT: A tuition credit will be given to cover the cost of in-state tuition for the course.

PREREQUISITES: Linear algebra and elementary partial differential equations (knowledge of gradient, divergence, curl, etc.) . As the class size will be kept small to encourage discussion and interaction it is necessary to obtain permission of the instructor to take this course (please email me if you may be interested). No background in the equations of conductivity and elasticity is needed. Elementary analysis and numerical computation will be required though it is expected that the class will have different strengths in different areas.