

# WSU team probes below-surface flaws

Researchers at Wayne State University want to eliminate the guesswork in jet engine maintenance, machinery and electronics equipment assembly and super-fast computer performance.

The "guesswork" is in the form of microscopic, subsurface flaws so small that not even the most sophisticated equipment can detect them. Left unchecked, they can spread to the surface and quickly become large and damaging cracks.

The aircraft industry routinely uses ultrasonic waves and X-ray inspection to look for cracks," said Wayne State University Physics Professor Robert L. Thomas of Huntington Woods.

They will also use fluorescent dyes, irradiated (the dyed areas) with ultraviolet, "black," light and look to see if there is a crack that is glowing from the dye."

UNFORTUNATELY, Thomas

said, those techniques cannot detect very small surface cracks (a few thousandths of an inch long or less) or subsurface cracks. "But those may be the cracks you have to find. When a crack intercepts the surface, it can really grow."

Thomas is the head of a skilled team of physicists that is developing methods to find these previously invisible defects.

Other WSU faculty collaborating with Thomas include physics Professors Foo-Kuang Kuo of Troy and Lawrence D. Favo of Huntington Woods.

For the past eight years, experts from the U.S. and other countries have met with Thomas on Wayne State's campus to study thermal wave imaging — a process that involves heating a suspect area with a laser beam and then measuring heat, pressure, density levels and light deflection immediately above the sur-

face to find any telltale abnormalities.

"With thermal wave imaging," Thomas said, "we can tell the depth and width of a crack and whether it's closed or open. We can find voids, imperfections, cracks and delaminations. We've seen cracks as small as a thousandth of an inch in length and tightly closed."

ALTHOUGH THERMAL wave imaging is extremely effective, it is still too slow a process for practical use in most manufacturing fields.

"In the newly created Manufacturing Research Institute at Wayne State, we're trying to increase the speed and the area you can inspect at one time, using an infrared camera," said Thomas, who became director of the institute in June.

Despite the time drawback, many industries still rely on the technique as an effective non-destructive evaluation test. They deal with its slow pace by restricting its use to high-stress areas where flaws are more likely to occur.

Thermal wave imaging has a potentially bright future in many different areas, Thomas said. He and several other scientists are already applying the technique to microelectronics.

"We're looking for defects in metal coatings like printed circuit loads, cracks in silicon layerings and poor adhesion of coatings on semiconductors," he said.

"THERE'S A tremendous financial incentive to do quantitative evaluation of cracks," Thomas said.

The U.S. Air Force, for example, replaces jet engine parts at predetermined time intervals as a precautionary measure. "They know that a large portion of the parts are still good, but they don't have a way to fully check them. If they could recover 50 percent of the good ones, there would be millions of dollars saved," Thomas said.

"In the electronic industry, many are beginning now to improve the yield of the chips and microelectronic devices. The thermal wave techniques may be able to contribute to that as a diagnostic technique where we could see the changes that take place during the manufacturing," he said.

# UM-Dearborn enrollment leaps

The University of Michigan-Dearborn began its fall semester with a record enrollment of more than 6,900 students, a 5-percent increase from fall 1985. Master's degree programs appeared to account for the bulk of the increase.

"We have not sacrificed quality for quantity," said Eugene Arden, UM-D's vice chancellor of academic affairs. This fall's freshman class has "academic records slightly better than last fall's."

The enrollment increase, in percentage terms, will be among the highest of the 15-public, four-year campuses in Michigan, Arden said.

UM-DEARBORN usually enrolls about 780 first-year freshmen with a new ACT test score of 24 (the state average is 19) and an academic grade-point average of 3.3 (B-plus).

Arden said it will take a few weeks to determine the reasons for the increase.

Preliminary indications are that graduate enrollment (master's de-

gree level) accounts for a sizeable portion of that increase, he said. UM-D offers master's-degree level programs in engineering, business, education and public administration.

The introduction of 11 undergraduate degree programs in the evening session is another likely source of enrollment increases. UM-D has attracted increasing numbers of part-time adult students to classes starting after 4:30 p.m., said Arden.

GRADUATE students usually account for about 7 percent to 8 percent of UM-D's enrollment.

Arden speculates that increasing numbers of Detroit-area professionals may be taking advantage of company tuition-reimbursement plans to complete graduate work in order to expedite career plans.

"With our location and the availability of a U-M degree (granted through the Rackham Graduate School), it is not surprising that Detroit-area residents find UM-D a good buy," Arden said.

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