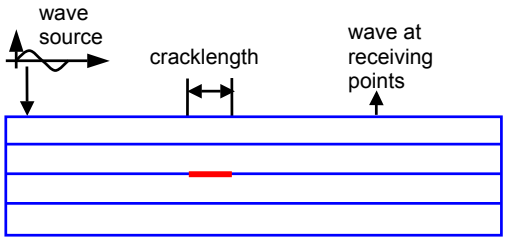
COMPUTATIONAL INVERSE TECHNOLOGIES FOR DETECTION OF CRACKS AND FLAWS

Codes Developed

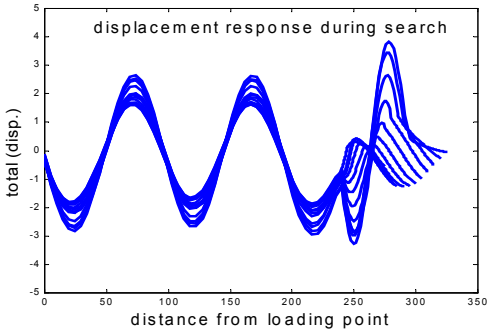
- **FlawDec** Analysis of time-harmonic response and flaw detection for anistropic sandwich plates
- **CracDec** Transient wave analysis and crack detection for anistropic laminated composite plates

Application Non-destructive evaluation (NDE) of cracks and flaws in anistropic sandwich plates and laminated composite plates.

Inverse technologies in wave propagation were originated from a notion that mechanical (elastic) waves traveling in materials would interact with or scatter from the boundaries and interfaces of materials, and propagate information that is encoded over distance. There are possibilities of extracting some information about the characteristics of the material from these encoded wave fields. A systematic method to extract the information is to formulate technologies and solve the inverse problems, such as non-destructive evaluation. Task of this nature arises in exploration, crustal and whole-earth geophysics, ocean acoustics, civil and environmental engineering, ultrasonic Non-destructive evaluation (NDE), biomedical ultrasonic, radar, solar astrophysics, and other areas of science, technology and engineering. The aim of this project is to develop techniques for solving problems related to detection of defects in anistropic laminated composite structures. Numerical investigation and experimental testing have been carried out extensively on dynamic response for detection of cracks (Fig.1) and flaws(Fig.2&3).

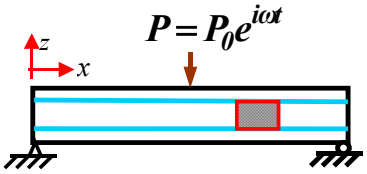


(a) de-lamination of composite plates

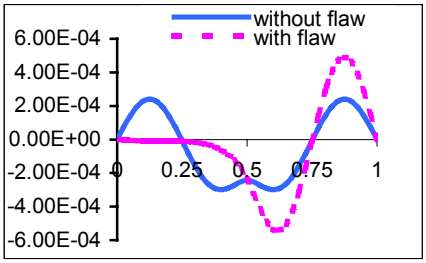


(b) displacement response during the searching

Fig.1 Detection of crack in the composite plates

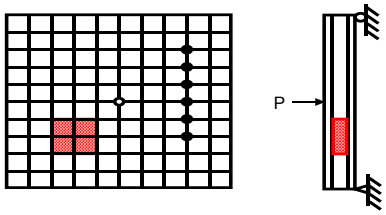


(a) sandwich beam with a flaw

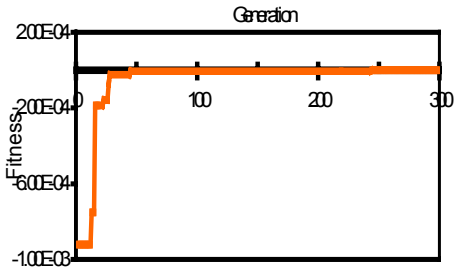


(b) displacement response

Fig.2 Displacement response with/without flaws



(a) simply supported sandwich square plate with a flaw



(b) fitness during the search process

Fig.3 Detection of flaws in sandwich plates