# Curvilinear Finite Difference (C-FD) solution of the fiber/matrix interface problem

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**Abstract**

*Keywords:* Fiber/matrix interface crack, Bi-material interface arc crack, Linear Elastic Fracture Mechanics (LEFM), Virtual Crack Closure Technique (VCCT), Finite Difference (FD), Curvilinear coordinates

## 1. Introduction

## 2. Analytical formulation

$$
\begin{aligned}
&\text{in } \Omega_f, \Omega_m :\\
&\frac{\partial^2 \varepsilon_{xx}}{\partial y^2} + \frac{\partial^2 \varepsilon_{yy}}{\partial x^2} = \frac{\partial^2 \gamma_{xy}}{\partial x \partial y}\\
&\varepsilon_z = \gamma_{zx} = \gamma_{yz} = 0\\
&\frac{\partial \sigma_{xx}}{\partial x} + \frac{\partial \tau_{xy}}{\partial y} = 0\\
&\frac{\partial \tau_{xy}}{\partial x} + \frac{\partial \sigma_{yy}}{\partial y} = 0\\
&\sigma_{zz} = \nu \left(\sigma_{xx} + \sigma_{yy}\right)\\
&\text{for } 0^\circ \leq \alpha \leq \Delta\theta :\\
&\left(\overrightarrow{u}_m \left(R_f, \alpha\right) - \overrightarrow{u}_f \left(R_f, \alpha\right)\right) \cdot \overrightarrow{n}_\alpha \geq 0\\
&\text{for } \Delta\theta \leq \alpha \leq 180^\circ :\\
&\overrightarrow{u}_m \left(R_f, \alpha\right) - \overrightarrow{u}_f \left(R_f, \alpha\right) = 0\\
&\sigma_{ij} = E_{ijkl} \varepsilon_{kl}\\
&+ BC
\end{aligned}
$$

## 3. Curvilinear Finite Difference (C-FD) discretization

## 4. Conclusions & Outlook

## Acknowledgements