多失效模式线抽样方法修正公式推导

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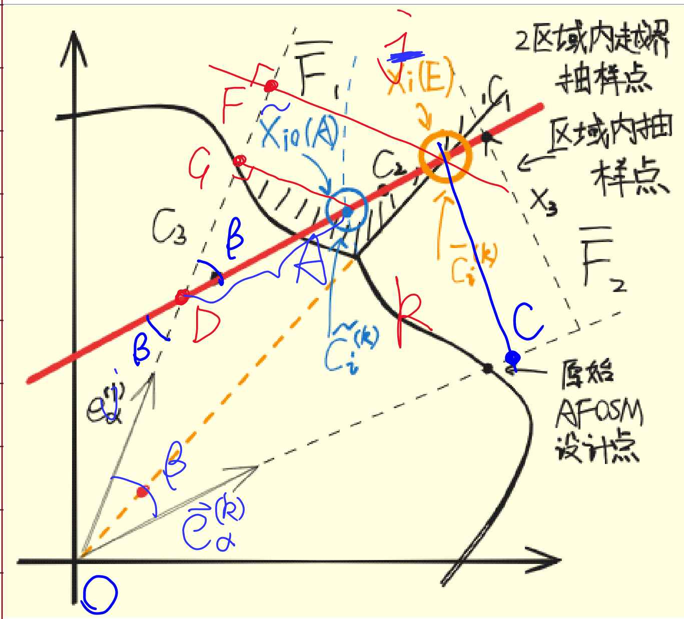

首先：设两条线夹角为 β

然后做垂线使得

$EF \perp FD$，显 $\angle EFD = \beta$

显有：

$EF = EC = \gamma^{(k)}(\bar{X}_i^{(k)})$

即相应垂线距离

因此：

$$l_{AE} = l_{DE} - l_{AD} = \frac{EC}{\sin\beta} - l_{AD}$$

由于 $l_{AD} = \frac{l_{AG}}{\sin\beta}$，设原失效域 k，另一个为 j，则

$$l_{AE} = \frac{\gamma^{(k)}(\bar{X}_i^{(k)})}{\sin\beta} - \frac{\gamma^{(j)}(\tilde{X}_i^{(k)})}{\sin\beta}$$

显然垂直距离 $\gamma^{k}(\bar{X}_i^{(k)}) = \gamma^{k}(\tilde{X}_i^{(k)})$

上式会写为：

$$l_{BE} = \frac{\gamma^{(k)}(\tilde{X}_i^{(k)}) - \gamma^{(j)}(\tilde{X}_i^{(k)})}{\sin\beta} = \boxed{\left|\frac{\gamma^{(k)}(\tilde{X}_i^{(k)}) - \gamma^{(j)}(\tilde{X}_i^{(k)})}{\sqrt{1-\langle e_\alpha^{(j)}, e_\alpha^{(k)}\rangle^2}}\right|}$$ ☆

$\gamma^{(k)}$ 表示到 $\vec{e}_\alpha^{\,k}$ 线垂直距离，并有：

$$\gamma^{(k)}(X) = \|\vec{X} - \langle \vec{X} \cdot \vec{e}_\alpha^{(k)}\rangle \vec{e}_\alpha^{(k)}\|$$

此时：得到修正 $\bar{C}_i^{(k)}$ 公式：

$$\boxed{\bar{C}_i^{(k)} = \tilde{C}_i^{(k)} + \mathrm{sign}(\tilde{C}_i^{(k)}) \frac{\gamma^{(k)}(\tilde{X}_i^{(k)}) - \gamma^{(j)}(X_i^{(k)})}{\sqrt{1-\langle e_\alpha^{(j)}, e_\alpha^{(k)}\rangle^2}}}$$