Evaluate $\int \cos 2\theta \log_e \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}\right) d\theta$

$I = \int \cos 2\theta \log_e \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}\right) d\theta$

$\qquad = \log_e \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}\right) \int \cos 2\theta d\theta - \int \left(\left[\log_e \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}\right)\right]' \int \cos 2\theta d\theta\right) d\theta$

$= \frac{\sin 2\theta}{2} \log_e \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}\right)$

$\qquad\qquad - \int \frac{\sin 2\theta (\cos \theta - \sin \theta)}{2(\sin \theta + \cos \theta)} \cdot \frac{2}{(\cos \theta - \sin \theta)^2} d\theta$

$= \frac{\sin 2\theta}{2} \log_e \left(\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta}\right) - \int \tan 2\theta d\theta$

$I = \sin 2\theta \log_e \sqrt{\frac{\sin \theta + \cos \theta}{\cos \theta - \sin \theta}} - \frac{1}{2} \log_e |\sec 2\theta| + c$