

Électricité de France

# Cracking kinetics under complex loadings

An EDF research and development team entrusted the Cetim with an experimental research program aiming at improving EDF's R&D knowledge in the field of crack growth under multiaxial loadings.

**T**he experimental study entrusted to the Cetim was aimed at determining the effect of loading mode on circumferential transverse fatigue crack growth speed and assessing possible scale effects.

## Tests in KI and KIII mode

*"Due to the lack of data concerning a complex loading mode (mode I and III), our theoretical studies did not seem to match onsite observations, explains Jean-Christophe Le Roux, R&D engineer in the EDF Renardières site. In order to improve and validate our results, we wanted to carry out growth tests in mode I and III on 20 and 40 mm diameter test specimens. Now, only Cetim*

*had the means and know-how required to carry out this type of tests on large-size test specimens."*

Then, the first objective consisted in determining cracking kinetics according to loading patterns and comparing the results. The second objective consisted in studying more specifically the possible scale effect with 20 and 40 mm diameter test specimens.

The development of the experimental bench started in late 2002. The last tests in KI (bending and rotation) and KIII (application of torsion torque) mode were performed in 2006. They allowed the effects of loading mode on cracking kinetics to be highlighted and characterised.



## OUR CUSTOMER

**Corporate name:**  
EDF R&D

**Activity:**  
Research and development related to all trades in the EDF group

**Country:**  
France

**Workforce:**  
2,000 people

## Cetim's asset



Cetim designs test benches and specific methods to carry out fatigue tests on the parts entrusted to us by clients.

## Observations validated by expertise

*"These studies reinforced the substantiation that observed cracking speeds are lower than the ones determined by calculations integrating "pure" KI pattern laws only, says Jean-Christophe Le Roux. They also showed that there was no scale effect for the test specimen dimensions studied."*