

4.1.3. THE ROOTS OF IN-SERVICE NDT PERFORMANCE REQUIREMENTS

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Goal of in-service NDT carried on engineering plants and structures is to reduce operational risk via contribution to insurance of their structural integrity. NDT in structural integrity assessment has two directions. The one is from the NDT point of view is to supply most reliable data on presence of flaws (in terms of size, location, characteristics, proximity of other flaws, ...) and the other one is from the fracture mechanics point of view is to formulate the requirements against NDT performance. In the past decades the practical application of both NDT and fracture mechanics has developed parallel and almost regardless to the other's development although these areas are inseparable in determination of reliable operating conditions as described above.

One of the basic problems in reliability assessment of engineering components having crack like flaws is on how the crack sensitivity of the component can be defined in terms of characteristic numbers. If we would be able to define it than the hazard of different flaws could be compared by pure numbers, i.e. it could be said that this flaw is, for instance, three times more hazardous than another flaw. The definition and introduction of a *Crack Propagation Sensitivity Index (CPSI)* of a component has fundamental meaning because the experimental results of the NDT, the loading conditions and the crack propagation resistance are physically connected by applying fracture mechanics principles in the components reliability assessment.

The CPSI of construction elements of quasi-statically and cyclically loaded components has been defined and suggested to introduce. The CPSI of structural elements for (i) quasi-static loading is the derivative of the K stress intensity factor vs. a crack depth function, and for (ii) cyclic loading is the slope of the logarithm of residual life time vs. a crack length function. Using this physically established definition, the reliability of the structural element (RSE) having crack like flaws and the reliability of the NDT results and determination of crack propagation resistance (CPR) of structural materials create a „closed-loop system”, i.e. the strongly interconnected requirements for the RSE, NDT and CPR can be justified.

In the presentation the practical applicability of CPSI concept will be demonstrated by various examples developed for pipelines, pressure vessels, etc.