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# INTER-INFLUENCE OF DEFECTS IN WELDED JOINT ZONE AT DIFFERENT FORCE LOADING

V.I. MAKHNENKO, E.A. VELIKOIVANENKO, A.S. MILENIN, G.F. ROZYNKA and N.I. PIVTORAK

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It is noted that force interaction of group discontinuity defects of material in welded structures is not necessarily reduced to the concept, according to which the adjacent defect impairs the service load resistance or does not affect it at a sufficiently large distance between them. A variant is considered, when interaction of group defects of the type of cracks or wall thinning defects, improves the resistance to service loading.

**Keywords:** welded joints, group defect interaction, parallel defects, collinear defects, fracture probability

Extent of damage of a particular structure under specific service conditions is usually determined by the number of found inadmissible defects. It is natural that the greater the number of such defects, the more damaged the examined structure is believed to be. The existing rules of allowing for inter-influence of defects [1–3, etc.] are usually reduced to combining by the respective rules two or more admissible defects located closest to each other into one independent admissible (inadmissible) defect based on a concept, according to which the neighbouring defect impairs or does not influence the service load resistance of this defect.

Such a concept is quite simple, but on the whole it is too conservative in a number of cases, as it does not allow for the possibility of a third alternative, namely that the neighbouring defect can unload this defect, and thus, improve its performance under specific service conditions.

Allowing for the third alternative at engineering diagnostics of structures requires application of the appropriate calculation procedures, normative documents, etc. but, nonetheless, considering the modern tendencies in development of computer engineering,

methods of mathematical modeling, information systems, as well as growing requirements to optimization of the developed critical structures, the good prospects for application of these developments are undoubtful, particularly for prediction of safe operation of welded structures with long service life by the results of the respective engineering diagnostics of their state.

This paper deals with such a possibility for sufficiently characteristic in-service defects of welded structures in the form of cracks and thinning.

Let us start with the simplest examples of interaction of two and three through-thickness parallel cracks of the same dimensions in an unlimited plate, uniformly tensioned along a normal to crack plane (Figures 1 and 2) by stress  $\sigma$ . The characteristic of such defect loading is the stress intensity factor in crack tip  $K_I$ . Respective data from [4] for the case of two cracks are given in Figure 1 and in Table 1, and those for three cracks – in Figure 2, depending on distance between cracks  $d$ . These data show that  $d$  decrease noticeably lowers  $K_I$  values, both for two and for three cracks.

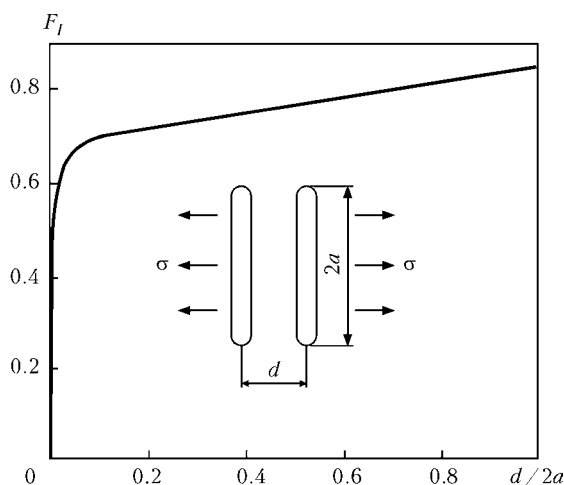


Figure 1. Dependence  $F_I = K_I / (\sigma \sqrt{\pi a})$  on  $d/2a$  [4]

Table 1. Numerical results [4]

$2a/d$	$F_I$
0	1.0000*
0.2	0.9855*
0.4	0.9508*
0.6	0.9089*
0.8	0.8727*
1.0	0.8319
1.25	0.8037
2	0.7569
5	0.6962
10	0.6651
100	0.5846

\*Plate with central crack.