WORK PLACE OF NDT OPERATOR (ARM-D) FOR DIGITAL PROCESSING OF ROENTGENOGRAMS

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Abstract: Program-hardware system has been developed for digitizing and processing weld roentgenograms. Initial image sources are as follows:
- roentgenogram on a film (positive or negative);
- photo on photographic paper (positive or negative);
- image sensor, connected to the computer.

Heuristically adaptive methods are used for "development" of the initial image to increase its information level. The work is performed by the operator in the interactive mode.
System capabilities:
- image scanning with a high resolution (up to 1200 dpi without interpolation), which allows cracks to be detected;
- simultaneous displaying in a multi-window mode of the entire image, photo fragment with a standard and several analyzed sections;
- independent scaling of images in each of the windows;
- direct measurement of the length of a section or broken line, as well as perimeter and area of a polygon, selected by the operator;
- inversion, rotation and mirror reflection of images;
- selection of an arbitrary number of fragments for processing at individual combination of parameters;
- storing an arbitrary number of iterations of image processing;
- storing the initial and processed images, as well as concurrent textual information in the computer data base;
- making safety copies of images on machine-readable carriers;
- ARM-D advantages is extreme simplicity of using the program;
- ability of applying the system under the laboratory, factory and field conditions;
- higher validity and effectiveness of NDT operator work;
- fast and flexible access to image archives.

Introduction: Non-disruptive monitoring is the most essential integral part of metal armature construction as it allows to guarantee high quality and safety of the product. In today's situation the role of non-disruptive monitoring acquires particular importance as virtually no country with developed IT-industry managed to avoid large-scale catastrophes entailed by unreliability of worn-down industrial facilities, in particular: trunk pipelines (oil, natural gas, water *etc*.), power stations of all kinds, bridges, system of public utility sector and so on.
Even the richest countries aren't able to replace all timeworn equipment. Thus, our main tasks are as follows:

- To generate digital copies of traditional archive images;
- To analyse archive files and define objects requiring immediate restoration;
- To examine technological infrastructure;
- To evaluate residual reserves of operating systems;
- To scrutinize archive data and reasons of catastrophes taking place in vital systems and collate the analysis results;
- To take preventive measures in the areas of potential danger;
- To intensify quality control system in order to strengthen reserves of new products.

Results: We have managed to develop a unique firmware system able to scan roentgenograms of welded seams. Initial image sources may be as follows:

- film roentgenogram (positive or negative);
- photo on photographic paper (positive or negative);
- computer-connected image sensor.

Striking success in the field of X-ray image processing was achieved due to introduction of the following advanced techniques:

- high resolving capacity of image digitising system;
- heuristic methods of image processing;
- extension of source data span;
- application of wide colour range allowing to improve quality of complex relief mapping (colour contrasting method);
- development of simple and efficient original software.

Large-scale processing of real data proved high efficiency of interactive computer image processing method. Here are two illustrations of image processing.

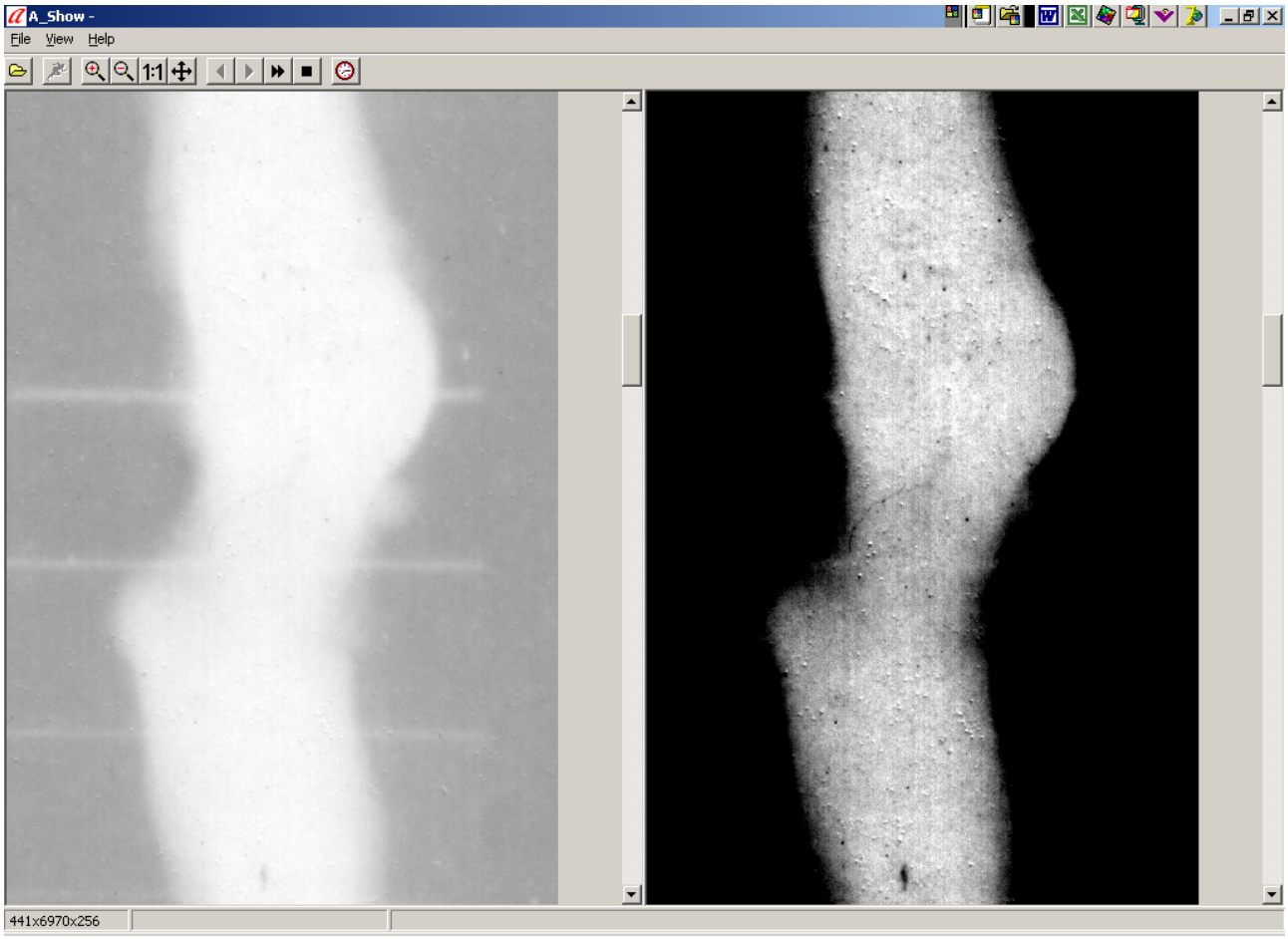

Fig. 1 Welded seam with crack before processing (left) and after processing (right).

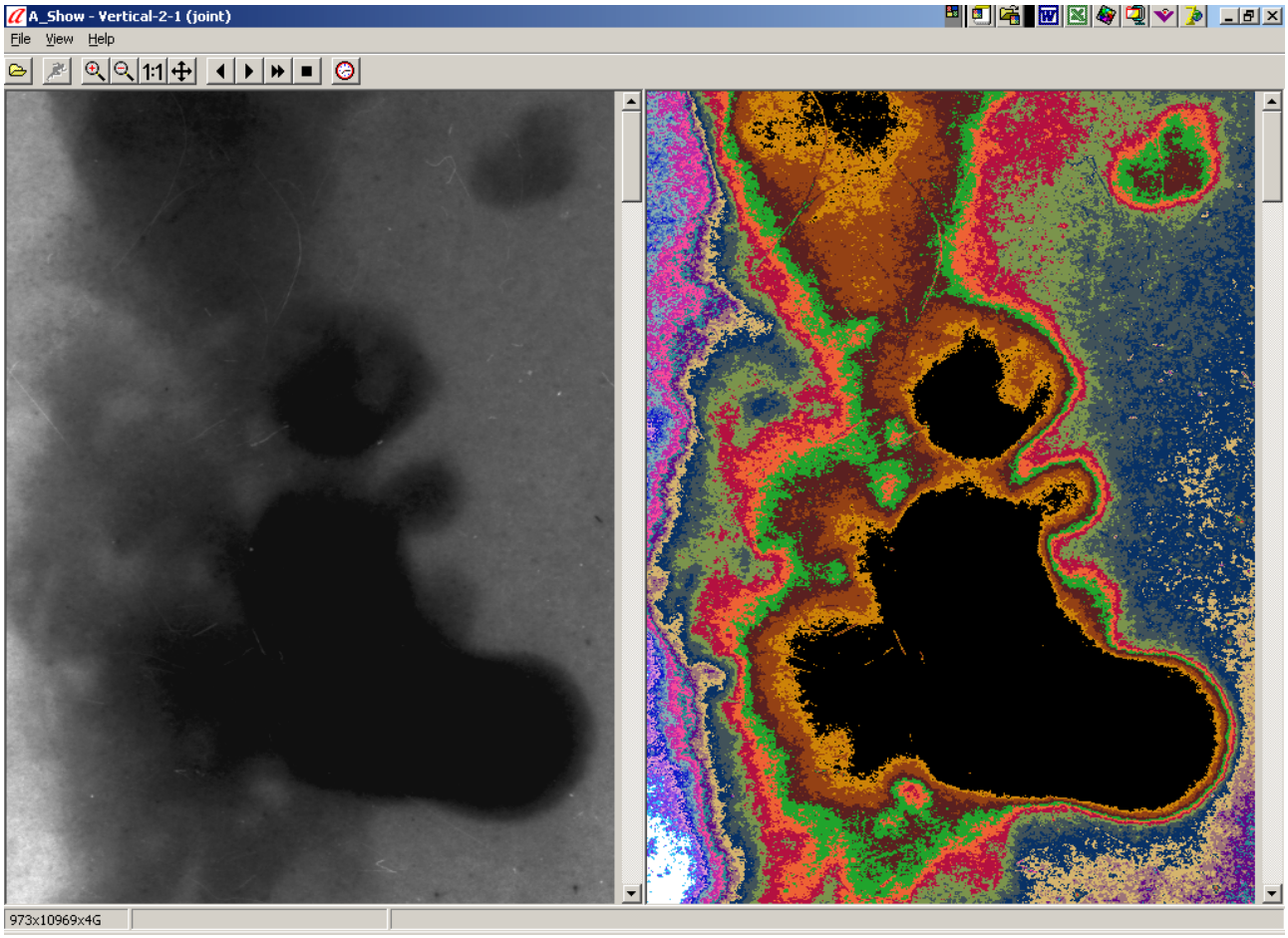

Fig. 2 Welded seam with crack before processing (left) and after processing (right).

Discussion: Further development of computer-aided defectoscopist's workstation will consist in computerization of some routine operations as well as introduction of new functions:

- automatic (or computer-aided) detection of defects;
- computation of geometrical parameters;
- realistic evaluation of danger level (based on special standard requirements);
- preparation of data necessary to assess reliability of objects;
- elaboration and maintenance of specialized databases;
- adaptation to specific equipment and technologies;
- adherence to technological standards in laboratory, industrial and field conditions;
- development of stationary and mobile defectoscopist's workstations;
- other projects.

Conclusions: Rapid advance in the sphere of computer and information technologies, observed over last years, allows to apply absolutely new approaches in the field of non-disruptive monitoring, analysis of X-ray images, in particular.

References: n/a