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X-RAY RADIOGRAPHY EXPOSURE BY COMPUTERIZES APPLICATION

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Abstract:

Radiographic imaging requires the preparation of a plan to identify the part to be imaged. Preparing an exposure plan previously required a wide-angle film. Therefore, the plan must be developed using advanced computer software that keeps pace with the precise scientific developments in radiological examinations. The relationship between the cathode current and the anode voltage of X-ray instrument , then linking it to the time of exposure relationship, and the necessary forms to meet these requirements based on engineering, physical, and mathematical principles, are essential to achieve the goal. The accuracy of the program is verified by calibrating the curve and comparing with intensity with respect to X-ray images of the model under test with the resulting exposure plan. The resulting exposure plan is a thickness exposure plan at 10, 120, 130, 140, and 150 kV. The accuracy of the results generated by this programming has been statistically shown to be 0.98.

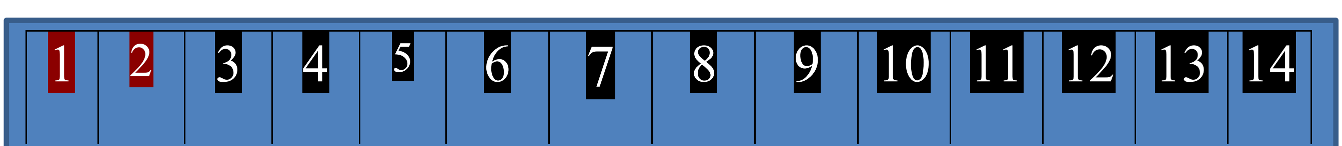
Keyword: Mat lap, mathematical calculations ,application, X-ray. radiography. statistically.

Introduction

The techniques used to conduct tests on alloys and their connections represent the maximum permissible radiation exposure. The primary dependence on thicknesses, quality and state of the material. Controlling radiation parameters and parameters using a flowchart is the beginning of any computer work. Using a flowchart representation the way to calculate the real exposure values. Resultant production high-resolution, high-contrast images. The saving times ensures efficiency and determines the exposure time to the atomic radiation produced by X-rays and complements the functions based on them [1, 2]. Relationship between materials thickness, cathode voltage and exposure time. Typical exposure to an X-ray usually represent by a graph that plots the relationship as a function of the exposure and materials thickness for different X-ray tube levels voltage. This can be determining and study radiation exposure to the materials then to calculate affective of their thickness for radiation fluxes.

Preparing and arranging materials:

The study of this states, Step wedges of steel thicknesses ranging from(2 to 14)mm. with plates of steel of(5) mm. thickness which used, as shown in Figure (1). The calculations of the exposure for every stress value of the tube. Characteristic curve was used to determine the film materials with used for this testing.



This study used a 250 EGS-3 X-ray tube . This machine has a voltage ranging from 100 kV to 200 kV, by a constant current with the range of (5)mA. MATLAB is used for computations. Matrix is the predominant components of MATLAB. This matrix-based approach enables mathematical calculations

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and image processing. In a short time, MATLAB has been used in a variety of scientific computational applications (8). Application and algorithm development and used as tools in MATLAB. Numerical calculations and the data analysis with application distribution, and results dissemination [10].. The relationship between the parameters of the instrument, intensity, tube voltage, and intensity is

$E=IT$, **(1)**

where I is the current (mA) of tube and T represents the time of exposure in unit of second . The factors that affect exposure . Three parameters as remarked previously.
It can be expressed mathematically by the equation

$$I_1 / I_2 = D_1^2 / D_2^2. \quad (2)$$

The new expression as mathematical form represents by equation (3)

$T_1 / T_2 = D_1^2 / D_2^2$ ·**(3)**

When the distance between the source and the film is kept constant, and the exposure required for a given function proportional inversely with respect to time . This can be expressed mathematically by Equation (4).

$M_1 / M_2 = T_2 / T_1$. **(4)**

The density of film can represent by the equation (5)

$D = \log I_0 / I_t$.**(5)**

<u>Flow Chart of program :</u>

The program's workflow shown and represent by Fig. (2). The curve characterization's is calculated with X-ray a plates. The resulting X-ray density with all parameters become inputs for program to calculate the exposure correction. The graduated wedge is then X-rayed to calculate the exposure for multiples thicknesses for a given stress range .

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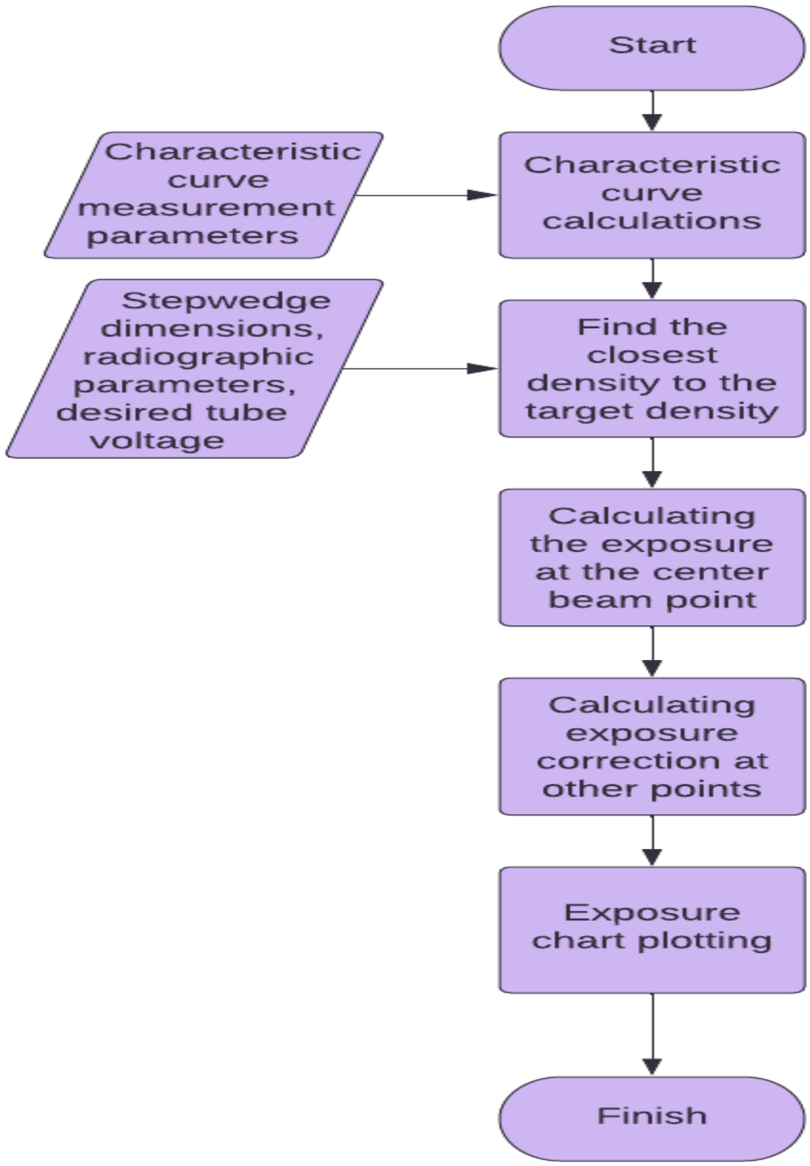

Figure 2. flow chart of Program. .

Results: Radiography imaging were performed using X-ray machine at the Testing Laboratory.
_The exposure chart is generated using a specially designed program. The program inputs consist of the stepped wedge exposure parameters; the stepped wedge dimensions; the stepped wedge density; and the film density characteristics; and the output parameters, namely the type of X-ray machine, the type of film used, the material, the film review density, and the required voltage. The program produces an exposure chart that can be saved in multiple formats. The exposure calculation at each voltage level is based on the input parameters, namely the tube voltage, current, tube, tube-to-film distance.To obtain the exposure at each voltage level, the calculation is performed the equation.

$$E = M \times T, \quad (6)$$

$$E = M \times \frac{RE_{out}}{\ } \times T_{in}, \quad (8)$$

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$$\overline{RE_{in}}$$

$$E = M \times T_{out} , \quad (7)$$

$E = (M \times RE_{out} / RE_{in}) \times T_{in}$ **(8)** Using the output exposure diagram shown in Figure 2.

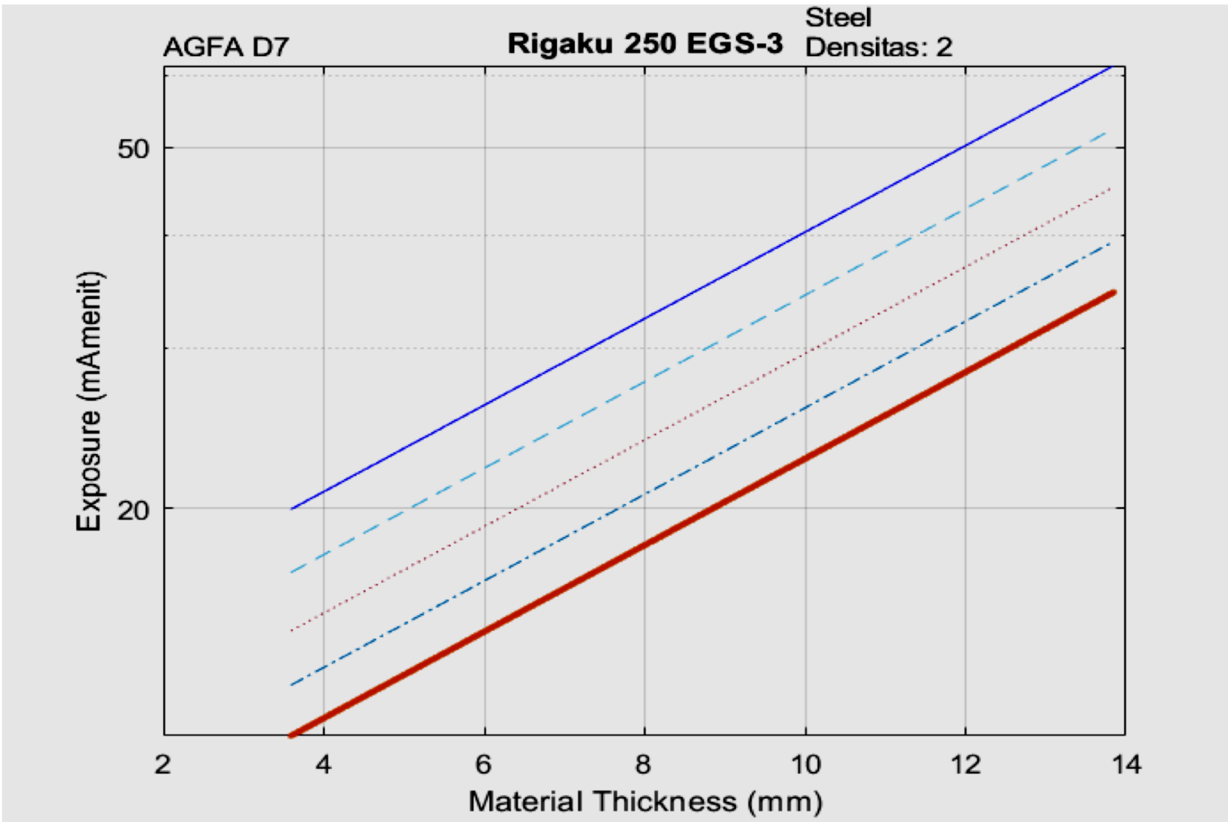

Figure 3. Generated exposure chart.

Table 1.The interpretation of the coefficients of calculations [16].

Interval correlation

> 0.91: good model expected.

0.80–0.90: Relatively accurate models prediction

0.66–0.80: The Model expected distinguishes low, medium, and higher values

0.51–0.65: With most than 50% of the Contrast of Y is influenced with the Contrast of X

Table 3. Program validation.

Tube voltage		Density		MAPE
110 kV	2.01	1.96	1.91	2.23%

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				2.24%
120 kV	**1.84**	**2.04**	**1.85**	**4.04%**
130 kV	**1.93**	**2.06**	**2.07**	**0.87%**
140 kV	**1.94**	**2.23**	**2.27**	**5.68%**
150 kV	**1.97**	**2.25**	**2.25**	**6.49%**

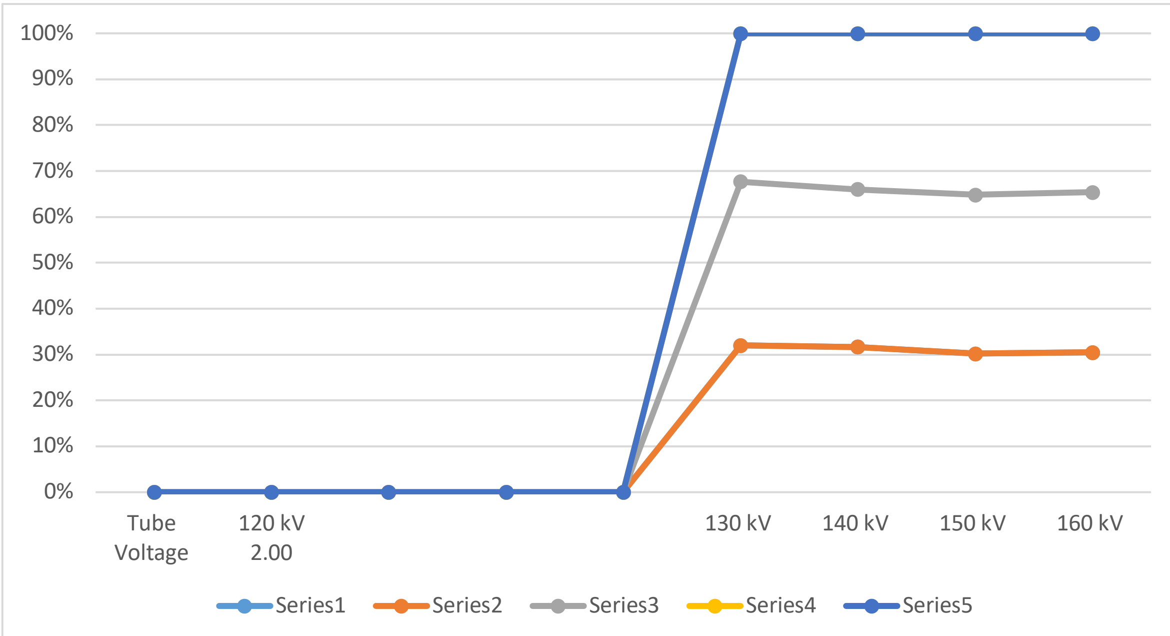

Figure (4): Relations of tube voltage as a functions of density and thicknesses.

6. Conclusions

The developing of program which produced to reduce the exposure of film in creating as application to X-ray charts. The film requirement for creating a conventional X-ray exposure chart can be reduced to only many pieces. All the results exposure charts have the higher error rate, 7.45%. The coefficient of determination for this chart is 0.98, providing higher accuracy. The program must require additional tests using variable range of the X-ray tubes with different and several materials. The applications by using a finite element method is better than the finite deference method in the later developments of programming.

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