Where $0 \leq \lambda \leq 0.25$ governs the rate of the diffusion and $N, S, E, W$ are the mnemonic subscripts for North, South, East and West respectively, and:

\[ c_N = g(|\nabla I_N|) \]
(13)

\[ c_S = g(|\nabla I_S|) \]
(14)

\[ c_E = g(|\nabla I_E|) \]
(15)

\[ c_W = g(|\nabla I_W|) \]
(16)

The choice of the threshold $K$ is somewhat difficult; it can be fixed arbitrarily or by estimating the noise. For this purpose, the authors in [9] proposed to choose it using the cumulated histogram of the gradient. Generally speaking, if $K$ is big, the preservation of the edge will be better, however the noise will not be sufficiently removed; but if $K$ is small, the noise will be well removed, but the edges of the image will be blurred.

Let $\phi(\nabla I)$ be the flux function as defined in [9]:

\[ \phi(\nabla I) = g(\nabla I) \cdot \nabla I \]
(17)

A large flux value indicates a strong effect of smoothness. Figure 3 presents the evolution of the diffusion coefficient function and the flux function given by equations (10) and (17), respectively.

For a given value of $K$, it is shown from figure 3(a) that the curve of the diffusion coefficient function in equation (10) decreases intensively and becomes near zero when the gradient magnitude $|\nabla I|$ is greater than $4K$.

Therefore, the diffusion stops when $|\nabla I| > 4K$.

The maximum smoothness occurs at $|\nabla I| = 1K$, as can be seen in the corresponding flux function in Figure 3(b). The classical model of PMAD can actually smooth intra-regions in the image.

Consequently, in a low contrast image, the PMAD model can smooth the background but it can not clearly enhance the defects. Therefore, the result of diffusion still a low contrast image and defects will not be reliably identified in the diffused image. The algorithm of the PMAD model is given in the Tab. 1.

Some simulation results of the PMAD applied to images of weld are given in figure 7 and 8. Indeed figures 7(a1), 7(a2), and figures 8(a1) and 8(a2) represent four radiographic images of weld with Internal Undercut, External Undercut, Lack of Fusion and Lack of Penetration defects, respectively. Figures 7(b1–b2) and 8(b1–b2) show the restoration results of the diffusing process using PMAD model with a parameter $K= 2$, and figures 7(c1–c2) and 8(c1–c2) represent the result of the binarization of these images with the Otsu method [20].