FBP algorithms for attenuated fan-beam projections

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Corrigendum

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There are two different expressions of the derivative of Hilbert transform (or ramp filter), which are:

\[ [Tg](s) = \frac{1}{\pi} \text{pv} \int_{-\infty}^{\infty} \frac{g'(l)}{s-l} dl \]  

(1)

\[ [Tg](s) = (T*g)(l) \]  

(2)

where \( T(\cdot) \) denotes the kernel function that might be regularized, \( g'(l) \) stands for the differentiation with respect to \( l \), and * is the convolution operator. Expression (1) can be understood mathematically without using the distribution theory, while expression (2) is usually used in numerical computations. Thus, (1) was used in the theoretical derivation in section 3, and (2) was used in the discretized formula (23) for numerical simulation in section 4 in the above paper. In the original paper, equation (13) seems to be straightforward but, after careful scrutiny, there turned out to be an error in the calculation of the partial derivative with respect to the variable \( l \). Since equations (7), (16) and (22) use expression (1), the error in (13) led to incorrect expressions in (16) and (22). However, this error does not affect formula (23) and the remaining simulation results. In order to make all the formulae consistent, equation (13) should be replaced by:

\[ \left( \frac{\partial}{\partial \sigma} - \frac{\partial}{\partial \beta} \right) g(\sigma, \beta) = (D \cos \sigma) \frac{\partial}{\partial l} (e^h p)(l, \theta)|_{l=D \sin \sigma, \beta=\sigma + \beta}. \]  

(13)

Accordingly formulae (16) and (22) should be replaced by

\[ \int_{0}^{2\pi} \int_{-\infty}^{\infty} \frac{e^{i\psi(\sigma, l - \psi(l, \theta))}}{\pi(s - l)} \frac{\partial}{\partial l} (e^h p)(l, \theta) dl d\theta \]

\[ = \int_{0}^{2\pi} \int_{-\pi/2}^{\pi/2} \frac{W_{\beta}(r, \varphi, \sigma')}{\pi K \sin(\sigma' - \sigma)} \left( \frac{\partial}{\partial \sigma} - \frac{\partial}{\partial \beta} \right) g(\sigma, \beta) d\sigma d\beta \]

\[ = \int_{0}^{2\pi} \frac{W_{\beta}(r, \varphi, \sigma')}{\pi K} d\beta \int_{-\pi/2}^{\pi/2} \frac{d\sigma}{\sin(\sigma' - \sigma)} \left( \frac{\partial}{\partial \sigma} - \frac{\partial}{\partial \beta} \right) g(\sigma, \beta) \]  

(16)

and

\[ f(r, \varphi) = \frac{1}{4\pi} \text{Re} \int_{0}^{2\pi} \frac{W_{\beta}(r, \varphi, \sigma')}{\pi K} d\beta \int_{-\pi/2}^{\pi/2} \frac{d\sigma}{\sin(\sigma' - \sigma)} \left( \frac{\partial}{\partial \sigma} - \frac{\partial}{\partial \beta} \right) g(\sigma, \beta) \]

\[ + \frac{1}{4\pi} \text{Re} \int_{0}^{2\pi} \frac{W_{\beta}(r, \varphi, \sigma')}{\pi K} d\beta \int_{-\pi/2}^{\pi/2} g(\sigma, \beta) D \cos \sigma \frac{d\sigma}{\sin(\sigma' - \sigma)}. \]  

(22)

There was also a misprint on page 1190: ‘Equation (32)’ in the first line of the last paragraph should be ‘Equation (31)’.

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