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Infinite Impulse Response Digital Filters Design

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Abstract : Infinite impulse response (IIR) filters can be designed from an analogue low pass prototype by using frequency transformation in the s-domain and bilinear z-transformation with pre-warping frequency; this method is known as frequency transformation from the s-domain to the z-domain. This paper will introduce a new method to transform an IIR digital filter to another type of IIR digital filter (low pass, high pass, band pass, band stop or narrow band) using a technique based on inverse bilinear z-transformation and inverse matrices. First, a matrix equation is derived from inverse bilinear z-transformation and Pascal's triangle. This Low Pass Digital to Digital Filter Pascal Matrix Equation is used to transform a low pass digital filter to other digital filter types. From this equation and the inverse matrix, a Digital to Digital Filter Pascal Matrix Equation can be derived that is able to transform any IIR digital filter. This paper will also introduce some specific matrices to replace the inverse matrix, which is difficult to determine due to the larger size of the matrix in the current method. This will make computing and hand calculation easier when transforming from one IIR digital filter to another in the digital domain.

Keywords : bilinear z-transformation, frequency transformation, inverse bilinear z-transformation, IIR digital filters
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