the amplitude, offset or shape can be modified to the desired levels at the test section through the use of the pump. Thus, this device fulfills the design goals of providing a pressure source for small blood vessel experiments, but may be applied to a variety of experimental systems as well.

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Correction to "Reduced Order Kalman Filtering for the Enhancement of Respiratory Sounds"

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In the above paper[1] a portion of Section II was omitted. The omitted text is the paragraph beginning "Under these assumptions..." For clarity, Section II is printed here in its entirety. We apologize to the authors and readers for this omission.

II. Models for the Heart and Respiratory Signals

Signal estimation using ROKF requires a mathematical model for the signal to be estimated (desired) as well as for the observation process. In this paper, the heart sounds are considered as the desired signals to be estimated while the respiratory sounds are assumed to be additive colored noise. Three assumptions are made based upon the properties of these contributing signals for the modeling and cancellation purposes.

1) The interaction between the heart and respiratory sounds is additive [5], [6].
2) The Signals are considered to be mutually uncorrelated processes as they are generated from from independent sources, while they are correlated themselves [5], [6].
3) Prior and subsequent heart sounds are linearly related to the heart sounds corrupted by the respiratory signal.

Under these assumptions the observation equation can be written as

$$z(k) = x(k) + v(k) \tag{1}$$

where $z(k)$ is to the acquired signal, $x(k)$ represents the heart signal, and $v(k)$ corresponds to the respiratory signal. The dynamics of the heart signal is modeled by an Mth-order AR model driven by a white Gaussian noise process, i.e.,

$$x(k) = -\sum_{n=1}^{M} a_n x(k-n) + u(k) \tag{2}$$

where a_n is the model coefficient, $n \in [1, M]$, and $u(k)$ is a zero-mean white Gaussian noise with variance σ_u^2. The AR model fits the spectral characteristics of the heart sounds since its power spectral density (PSD) possesses distinctive peaks. This model is arrived at by using the heart information present in the manually extracted sections of an acquired signal that are free of respiratory sounds.

To represent the dynamical model (2) in state equation, we define a state vector that contains the current and past values of the heart signal, i.e., $\underline{\boldsymbol{x}}(k) = [x(k-M+1)x(k-M+2)\cdots x(k-1)x(k)]^t$. Using this state assignment and the AR model in (2), the following state equation can be obtained:

$$\underline{\boldsymbol{x}}(k) = \boldsymbol{F}\underline{\boldsymbol{x}}(k-1) + \boldsymbol{G}u(k) \tag{3}$$

where

$$F = \begin{bmatrix} 0 & 1 & 0 & \cdots & 0 \\ 0 & 0 & 1 & \cdots & 0 \\ \vdots & \vdots & & \vdots & \vdots \\ -a_M & -a_{M-1} & & \cdots & -a_1 \end{bmatrix} \text{ and}$$

$$G = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 1 \end{bmatrix}.$$

The observation equation (1) can now be expressed in terms of the state vector $\underline{\boldsymbol{x}}(k)$ as

$$z(k) = \boldsymbol{H}\underline{\boldsymbol{x}}(k) + v(k) \tag{4}$$

where $\boldsymbol{H} = [00\cdots 1]$. Note that in the above equations, even though the driving process $u(k)$ is a white process, $v(k)$ is a colored process owing to its band-limited behavior. Thus the standard Kalman filter can not be applied. This calls for the ROKF which is reviewed briefly in the next section.

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