Chaotic oscillator from a PMSM model using DS

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Dynamical properties of chaotic systems suggest complexity for a physical implementation. This paper presents a chaotic oscillator using the TMS320C6713 DSP. The implemented chaotic oscillator corresponds to a scaled version of the model of a permanent-magnet synchronous motor (PMSM) that presents chaos for some values of its parameters, this model was presented and discussed in [1] and is given by the following equations:

\[
\begin{align*}
\dot{x} &= 20(-bx + 200yz), \\
\dot{y} &= 20(-y - 200xz + cz), \\
\dot{z} &= 20(a(y - z) + 200\xi xy).
\end{align*}
\]

Traditionally, a chaotic oscillator is implemented with analog components, but this has changed because of many benefits provided by a DSP [2]. Time series of all state variables of the chaotic oscillator with DSP were obtained and three different methods were applied in order to establish its chaotic properties. We found: 1) The largest positive Lyapunov exponent; 2) Poincare map; and 3) Fourier Transform. Chaotic signals can be used in data encryption [3], [4], and generate chaos like behavior in some physical application where it is desired [5], and so on. This work was supported by SEP-CONACYT project 78890 and DGEST project TIJ-IET-2009-217, MEXICO.

References