Supplementary Material for Chapter 8: "Multisensor, Multichannel, and Time-Space Processing" [1]

Prof. Boualem Boashash, Editor.

The zip files contained in this directory contain the supplementary materials[2] (SM) for each Section of the Chapter separately. The user is advised to read the read me file for each Section to get a good overview of the contents of its SM. Below is a brief overview of the Chapter in the book. Part 2, next page, is the actual inventory of the SM provided for this chapter.

1. Book Chapter SM Overview:

This chapter presents time-frequency ((t, f)) techniques that are suitable for multi-channel signal processing, using multi-sensor and time-space processing methods. The topics for which SM is available are described below.

Multi-channel/multi-sensor (t, f) signal processing describes the extension of (t, f) methods to incorporate the spatial diversity provided by multi-sensor recordings; this is illustrated in localizing abnormality sources in the brain using EEG (8.1: see page 2). The multichannel data can then be processed with TFDs for channel estimation and equalization. In Blind Source Separation (BSS) and Direction of Arrival (DOA) estimation problems, the (t, f) approach to array signal processing leads to improved spatial resolution and source separation performances. Methods include (t, f) multiple signal classification (MUSIC), and TFD-based BSS (8.2: see page 2). In underwater acoustics and telecommunications, separation of signal mixtures is traditionally based on methods such as Independent Component Analysis (ICA) or BSS. These can be formulated using TFDs to deal with the case of non-stationary signals (8.4: see page 2). In the underdetermined case, where the number of sensors is less than the number of signals, (t, f) formulations, methodologies and algorithms for BSS are implemented using vector clustering and component extraction techniques (8.5: see page 2). Finally, Section 8.6 describes a method where audio source localization and separation can be improved using multi-sensor *(t, f)* analysis (8.6: see page 2).[3]

---

[1] B. Boashash (ed.), Time-Frequency Signal Analysis and Processing, 2nd Edition (London: Elsevier / Academic Press, December 2015); ISBN 978-0-12-398499-9.

[2] All of the book supplementary materials can be found here.

[3] The reader is encouraged to do a literature search of papers published on the topic of this chapter by Prof. Boashash and co-authors, after May 2017.

2. Book Chapter SM Main Script Inventory:

Supplementary material	Brief Description
Section 8.1: Multisensor Time-Frequency Analysis and Processing: Methods for Multichannel Nonstationary Data	
Time_Freq_MUSIC_Main_Avg.m	This script produces similar results to the ones that are depicted in Fig. 8.1.10(a), on page 465 of the book.
TF_MUSIC_AvgError.m	This script produces similar results to the ones that are depicted in Fig. 8.1.10(b), on page 465 of the book.
Section 8.2: Spatial Time-Frequency Distributions	
Example_1.m	This script produces the results that are depicted in Figs. 8.2.3 and 8.2.4, on page 472 of the book.
tf_music.m	This script produces results that are similar to the ones depicted in Fig. 8.2.6, on page 474 of the book.
Fig_8_2_7.m	This script produces the results that are depicted in Fig. 8.2.7, on page 475 of the book.
Section 8.4: Blind Source Separation Using Time-Frequency Distributions	
instantaneous_mix.m	This script produces results that are similar to the ones in Figs. 8.4.1 and 8.4.2, on pages 490-491 of the book.
convolutive_sound.m	This script produces results that are similar to the ones depicted in Fig. 8.4.3, on page 492 of the book.
convolutive_mix.m	This script is an additional example that uses the same techniques utilized to produce the results that are depicted in Fig. 8.4.3, on page 492 of the book.
Section 8.5: Underdetermined Blind Source Separation for FM-Like Signals	
Fig_8_5_1.m	This script produces the results that are depicted in Fig. 8.5.1, on page 494 of the book.
Fig_8_5_4.m	This script produces the results that are depicted in Fig. 8.5.4, on page 498 of the book, and can be used to produce Fig. 8.5.5, on page 499 of the book.
Fig_8_5_7.m	This script produces the results that are depicted in Fig. 8.5.7, on page 502 of the book.
Section 8.6: Audio Source Localization and Separation Using Time-Frequency Representations	
Fig_8_6_2.m	This script produces the results that are depicted in Fig. 8.6.2, on page 509 of the book.