Supplementary Material for Chapter 11: "Time-Frequency Synthesis and Filtering" [1]

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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 methods and techniques to design time-varying linear systems such as filters with precise time-frequency ((t, f)) specifications; this capability can then allow one to accurately model and predict the effects of linear systems on non-stationary signals in applications such as signal cleansing and enhancement. The topics for which SM is available are described below.

The design of time-varying filters is useful in applications where it is desired to separate, suppress or reduce undesired nonstationary signal components. This can be done by various methods such as the STFT and Gabor transform (11.1: see page 2). The use of the Gabor expansion for time-varying filtering is illustrated on an application that involves monitoring machine vibrations. In addition, an alternative method, the inverse STFT, is applied to (t, f) filtering with an illustration on a speech signal (11.2: see page 2). Another adaptation of the procedure for designing a time-varying filter is provided in the context of an application involving hands-free telephone speech signals (11.3: see page 2). Another important application of time-varying filtering, namely signal enhancement, is described using an algorithm based on time-frequency peak filtering (11.4: see page 2). After that, a method for subspace noise filtering using a time-frequency distribution is described (11.5: see page 2); and finally a comparison of de-noising algorithms for speech enhancement completes the chapter (11.6: see page 2).

[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.

2. Book Chapter SM Main Script Inventory:

Supplementary material	Brief Description
Section 11.1: Linear Time-Frequency Filters	
script_11_1_3.m	This script reproduces the results that are depicted in Fig. 11.1.3 on page 644 of the book.
script_11_1_4.m	This script produces results that are similar to the ones depicted in Fig. 11.1.4 on page 644 of the book.
Section 11.2: Time-Varying Filtering Using the STFT and Gabor Expansion	
ScriptResults.m	This script produces a similar example to the one depicted in Fig. 11.2.2 on page 652 of the book.
Section 11.3: Time-Frequency Filtering of Speech Signals in Hands-Free Telephone Systems	
speech_time_varying_filtering.m	This script reproduces the results that are depicted in Figs. 11.3.1 and 11.3.2 on page 661 of the book.
Section 11.4: Signal Denoising by Time-Frequency Peak Filtering	
Figure_11_4_2_a.m	This script reproduces the results that are presented in Figure 11.4.2(a-c) on page 669 of the book
Figure_11_4_2_b.m	This script generates similar results to the ones presented in Figure 11.4.2(d-f) on page 669 of the book
Section 11.5: Subspace Noise Filtering Using Time-Frequency Distributions	
Sec_11_5_Figures1_to_5.m	This script reproduces the results that are depicted in Figs. 11.5.1-11.5.5 on pages 671 and 673-675 of the book.
Sec_11_5_Figure_6.m	This script reproduces the results that are depicted in Figs. 11.5.6 on page 677 of the book.
Sec_11_5_Figure_7.m	This script reproduces the results that are depicted in Fig. 11.5.7 on page 678 of the book.
11.6: Evaluation of Time-Frequency Denoising Algorithms for Speech Enhancement	
Test_algorithms.m	This script generates a similar example to the results depicted in Figs. 11.6.2, 11.6.3 and Table 11.6.1 on pages 686-687 of the book.