

Evaluating power consumption

Table of Contents

| | |
|--------------------|---|
| Introduction..... | 1 |
| A/D Converter..... | 1 |

Copyright (C) 2022 Miodrag Bolic

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version. This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details <<https://www.gnu.org/licenses/>>.

This code was developed by Miodrag Bolic for the book PERVASIVE CARDIAC AND RESPIRATORY MONITORING DEVICES: <https://github.com/Health-Devices/CARDIAC-RESPIRATORY-MONITORING>

We would like to acknowledge:

[1] G. Dekkers, F. Rosas, S. Lauwereins, S. Rajendran, S. Pollin, B. Vanrumste, T. van Waterschoot, M. Verhelst and Peter Karsmakers, ♦A multi-layered energy consumption model for smart wireless acoustic sensor networks, ♦ KU Leuven, Tech. Rep., December 2018. for providing the Matlab code. All the equations are from their paper.

```
% Changing the path from main_folder to a particular chapter
main_path=fileparts(which('Main_Content.mlx'));
if ~isempty(main_path)
    %addpath(append(main_path, '/Chapter2'))
    cd (append(main_path, '/Chapter4/PowerEstimation'))
    addpath(append(main_path, '/Service'))
end
SAVE_FLAG=0; % saving the figures in a file
```

Introduction

A/D Converter

```
% From paper [1]
T=1;
channels=1;
Nadc= 12 ;% # ADC resolution [bit]
fs=10000;
Ts=1/fs;
FOM= 100*1e-13*10^3; % # [mJ/conv]
% ADC consumption
Padc = 2^Nadc * fs * FOM % [mW] - eq. 10
```

```
Padc = 0.4096
```

```

Eadc = T*Padc*channels;          % [mJ] = [s]*[mW] - eq. 9

% Based on the data sheet for sigma delta ADS1114 from TI
i_oper=0.15;                      % [mA]
i_power_down=1e-3;               % [mA]
conversion_time=1/1000;          % [s]
Vdd=3;                           % [V]
Eadc=Vdd*(i_oper*conversion_time+i_power_down*(Ts-conversion_time));
Padc=Eadc/Ts                      %

```

```

Padc = 4.4730

```

```

% Based on the data sheet for successive approximation AD7684 from Analog Devices
i_oper=0.56;                      % [mA]
i_power_down=1e-6;               % [mA]
conversion_time=10e-6;           % [s]
Vdd=3;                           % [V]
Eadc=Vdd*(i_oper*conversion_time+i_power_down*(Ts-conversion_time));
Padc=Eadc/Ts

```

```

Padc = 0.1680

```

```

% Plotting power over sampling rates and Vdd
Vdd1=[2.7, 5];
i=1:1000;
fs1=100*i;
Ts1=1./fs1;
i_oper1=[0.56, 0.8];
Padc1(1,:)=Vdd1(1)*(i_oper1(1)*conversion_time+i_power_down*(Ts1-conversion_time))./Ts1;
Padc1(2,:)=Vdd1(2)*(i_oper1(2)*conversion_time+i_power_down*(Ts1-conversion_time))./Ts1;
loglog(fs1/1000,Padc1)
title('Power consumption of A/D converter AD7684')
xlabel('Sampling frequency (ksps)')
ylabel('Power consumption (mW)')
grid on
legend(['2.7V'], ['5V'])
annnotation_save('', 'Fig4.20.jpg', SAVE_FLAG);

```

