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%% Setup
clc; clear;

max_datarate = 250*1000*8; %250k-byte Telos_B datasheet
packagesize = 128*8; %128k-byte WSN Problem Description
TransmitPeriod = packagesize/max_datarate; %Seconds
ReceivePeriod = packagesize/max_datarate; %Seconds
latency = 6*10^(-3)*2; %Seconds
timesPerSecond = 4; %Seconds
packagePeriod = TransmitPeriod + ReceivePeriod + latency; %Seconds
os_time = 0.05; %-os = overshoot %Seconds

sleep_Period = 1-packagePeriod*timesPerSecond; %Sleep period for one package
every second
sleep_Period_OS = sleep_Period-os_time*timesPerSecond;
R = 1; %Measurement Shunt-Resistance

I_tx_max = 17.5*10.^(-3); %Transmit current
I_tx_min = 8*10.^(-3); %I_tx_max - 24dBm
I_rx = 23.0*10.^(-3); %Receive Current
I_sleep = 1*10.^(-6); %Sleep current

Ptx_max = I_tx_max*R^(2) * TransmitPeriod; %Max Transmit Power
Ptx_min = I_tx_min*R^(2) * TransmitPeriod; %Min Transmit Power
Prx_no_sleep = I_rx*R^(2) * (ReceivePeriod + latency + sleep_Period); %Receive Power
with no sleep
Prx_sleep = I_rx*R^(2) * (ReceivePeriod + latency); %Receive Power
with sleep
Ptsleep = I_sleep*R^(2) * sleep_Period; %Sleep Power
Ptsleep_OS = I_sleep*R^(2) * sleep_Period_OS; %Sleep Power minus overshoot time
Ptrx_OS = I_rx*R^(2) * os_time*timesPerSecond; %Sleep Power minus overshoot time

%% Overshoot overshoot setup and power calculations
os_Percentage = 0.4;
os_Top_max = Ptx_max * os_Percentage;
os_Top_min = Ptx_min * os_Percentage;
os_center = os_time/2; %sec

x = [0:.001:os_time];
f = Ptx_max + os_Top_max * exp(-((x-os_center).^2)/0.0001);
fun_max = @(x) os_Top_max * exp(-((x-os_center).^2)/0.0001);
OS_power_max = integral(fun_max,0,os_time);
fun_min = @(x) os_Top_min * exp(-((x-os_center).^2)/0.0001);
OS_power_min = integral(fun_min,0,os_time);

figure(1)
plot(x,f);
title('Gaussian distribution of a voltage peak after node wakeup')
xlabel('time(sec)') % x-axis label

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ylabel('Voltage over 1 Ohm ') % y-axis label
%% Total power and lifetime calculations

P_Total_max_no_sleep = Ptx_max + Prx_no_sleep; %Power without the sleep overshoot power
P_Total_min_no_sleep = Ptx_min + Prx_no_sleep;

P_Total_max_sleep = Ptx_max + Prx_sleep + Ptsleep; %Power without the sleep overshoot power
P_Total_min_sleep = Ptx_min + Prx_sleep + Ptsleep;

P_Total_max_sleep_OS = Ptx_max + Prx_sleep + Ptsleep_OS + OS_power_max + Ptrx_OS; %Power without the sleep overshoot power
P_Total_min_sleep_OS = Ptx_min + Prx_sleep + Ptsleep_OS + OS_power_min + Ptrx_OS;

% AA Battery https://en.wikipedia.org/wiki/AA_battery "RAM"
V = 1.5;
Ah = 2*2600*10^(-3); %mAh for two batteries
BatteryPower = V*Ah;

%Lifetime results PT(Power Time)
PT_Total_max_no_sleep = BatteryPower/P_Total_max_no_sleep; %Lifetime in hours
PT_Total_max_no_sleep = PT_Total_max_no_sleep/2 %Halfpower
Lifetime in hours
PT_Total_min_no_sleep = BatteryPower/P_Total_min_no_sleep; %Lifetime in hours
PT_Total_min_no_sleep = PT_Total_min_no_sleep/2 %Halfpower
Lifetime in hours
PT_Total_max_sleep = BatteryPower/P_Total_max_sleep; %Lifetime in hours
PT_Total_max_sleep = PT_Total_max_sleep/2 %Halfpower Lifetime
in hours
PT_Total_min_sleep = BatteryPower/P_Total_min_sleep; %Lifetime in hours
PT_Total_min_sleep = PT_Total_min_sleep/2 %Halfpower Lifetime
in hours
PT_Total_max_sleep_OS = BatteryPower/P_Total_max_sleep_OS; %Lifetime in hours
PT_Total_max_sleep_OS = PT_Total_max_sleep_OS/2 %Halfpower
Lifetime in hours
PT_Total_min_sleep_OS = BatteryPower/P_Total_min_sleep_OS; %Lifetime in hours
PT_Total_min_sleep_OS = PT_Total_min_sleep_OS/2 %Halfpower
Lifetime in hours

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