Introduction

Approach used for creating the pure sine wave described in this paper is done through manipulation of mathematical representation of the original sine wave. It is done by dividing half the sine wave into \( m \) (even number) segmentations, where area under a quarter of the sine wave from 0 to \( \pi/2 \) resembles series of the form \([2n-1]\) where \( n=1,\ldots, m/2 \), while areas of the next quarter from \( \pi/2 \) to \( \pi \) will resemble series of the form \([2n-1]\) where \( n=m/2,\ldots, 1 \).

![Figure 1. Dividing the sine wave into small segments](image)

**Block Diagram & Schematic**

The inverter will converts 12 Volt dc from battery into 110 Volt ac, 50 Hz, sine wave. Figure 2 and 3 show the block diagram and schematic circuit of the inverter.

![Figure 2. Block diagram of pure sine wave inverter](image)
Pulse train as shown in figures 5 is produced interchangeably from port (A) and port (B) by microcontroller 89S2051 during the positive half and negative half of the sine wave. The pulse train is then inputted to the MOSFET power switching circuit, which is next directed to the primary side of the transformer. Output of the secondary side is shown in Figure 6, which then be filtered resulting in the sine wave as seen in figure 7, where amplitude attenuation can reach up to 50%. Measured inverter output THD reaches 5-8%, where the largest harmonics appeared to be the second and third harmonics as shown in figure 8.

![Figure 3. Schematic of Pure Sine Inverter](image)

![Figure 4. PCB of Pure Sine Inverter](image)
Figure 5. Pulse train (m=10) of Atmel 89s2051

Figure 6. Secondary Side Transformer Output
Figure 7. Filter Output

Figure 8. Harmonic measurement result (Hioki)
Listing Software

;==============================================================================
; PROGRAM INVERTER OLEH: DIDIK ROSTYONO 2006
;==============================================================================
P1=INPUT    P3=OUTPUT
P1.2=TOMBOL START    P1.3=BATERE CEK
P3.0=DRIVER1    P3.1=DRIVER2
P3.4=BUZZER    P3.5=LED

;INISIALISASI (BEEP PENDEK + BEEP PANJANG)
ORG 00H
ON: MOV P3,#20H; DRIVER OFF, BUZZER OFF, LED OFF
ACALL DELAI; TUNGGU 1/4 DETIK
SETB P3.4; BEEP ON
CLR P3.5; LED BIRU ON
ACALL DELAI; TUNGGU 1/4 DETIK
CLR P3.4; BEEP OFF
SETB P3.5; LED BIRU OFF
ACALL DELAI; TUNGGU 1/4 DETIK
SETB P3.4; BEEP ON
CLR P3.5; LED BIRU ON
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
CLR P3.4; BEEP OFF
SETB P3.5; LED BIRU OFF
ACALL DELAI; TUNGGU 1/4 DETIK
;

;CEK KONDISI BATERE (LOW VOLTAGE = 2 X BEEP PENDEK)
CEK: JNB P1.3, MULAI;  CEK KONDISI BATERE
CLR P3.5; LED BIRU ON
SETB P3.4; BEEP ON
ACALL DELAI; TUNGGU 1/4 DETIK
SETB P3.5; LED BIRU OFF
CLR P3.4; BEEP OFF
ACALL DELAI; TUNGGU 1/4 DETIK
CLR P3.5; LED BIRU ON
SETB P3.4; BEEP ON
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
CLR P3.4; BEEP OFF
SETB P3.5; LED BIRU OFF
ACALL DELAI; TUNGGU 1/4 DETIK
;

;INVERTER MENUNGGU PENEKANAN TOMBOL ON
MULAI: SETB P3.5; LED BIRU OFF
CLR P3.4; BEEP OFF
MULAI1: JNB P1.2, START;  BACA TOMBOL START
CLR P3.5; LED BIRU ON
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
JNB P1.2, START;  BACA TOMBOL START
SETB P3.5; LED BIRU OFF
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
AJMP CEK

;INVERTER ON
START: SETB P3.5; LED BIRU OFF
CLR P3.4; BEEP OFF
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
ACALL DELAI; TUNGGU 1/4 DETIK
SETB P3.4; BEEP ON
CLR P3.5; LED BIRU ON
ACALL DELAI; TUNGGU 1/4 DETIK
CLR P3.4; BEEP OFF
ACALL DELAI; TUNGGU 1/4 DETIK

;PWM GENERATOR
PULSE: JNB P1.2,ON; JIKA STOP DITEKAN KEMBALI KE AWAL
       JB P1.3,ON; CEK KONDISI BATERE

PWM:
       CLR P3.0;
       CLR P3.1;
       SETB P3.0;
       ACALL PULSE_TRAIN;
       CLR P3.0;
       CLR P3.1;
       ACALL PULSE_TRAIN;
       CLR P3.0;
       CLR P3.1;
       AJMP PULSE

;RUTIN DELAI1
DELAI1: MOV R1,#2
L1:   MOV R2,#250
L2:   MOV R3,#250
L3:   DJNZ R3,L3
       DJNZ R2,L2
       DJNZ R1,L1
       RET