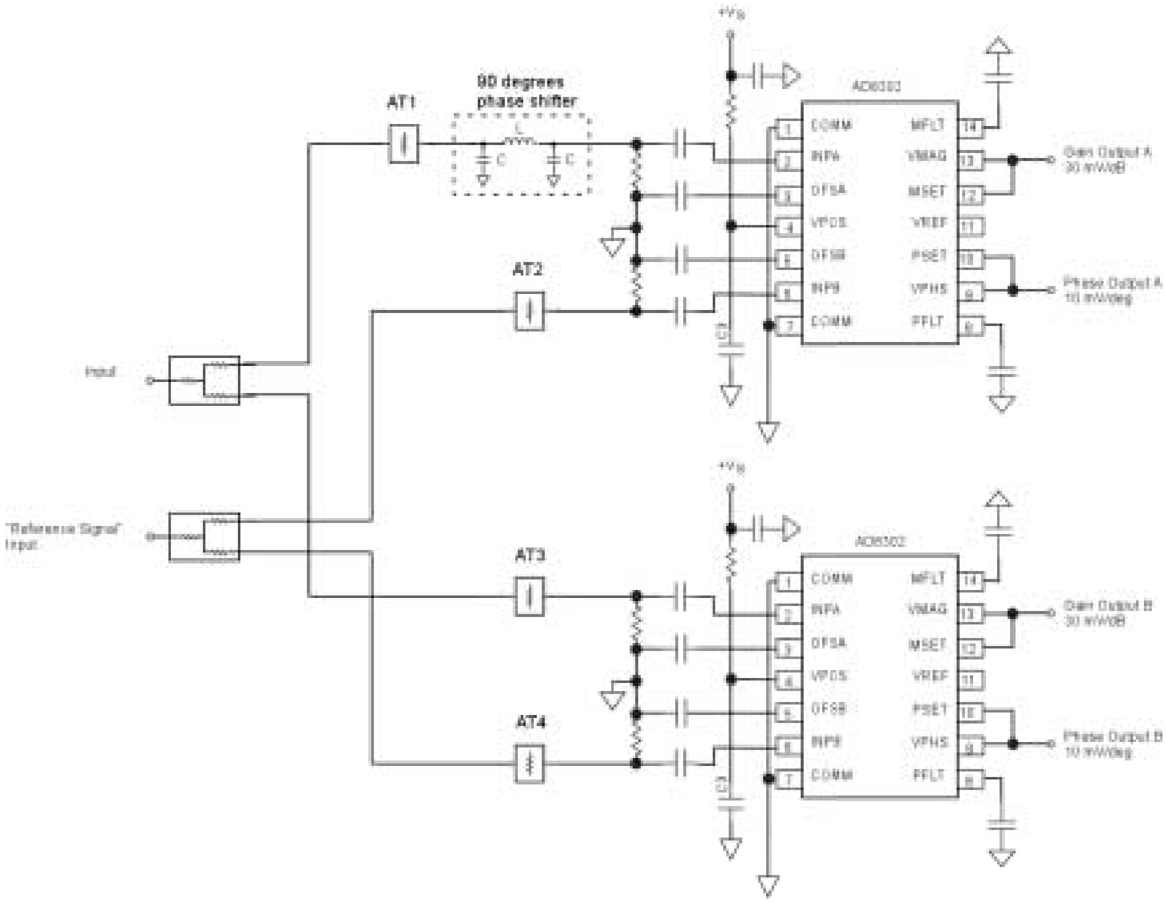
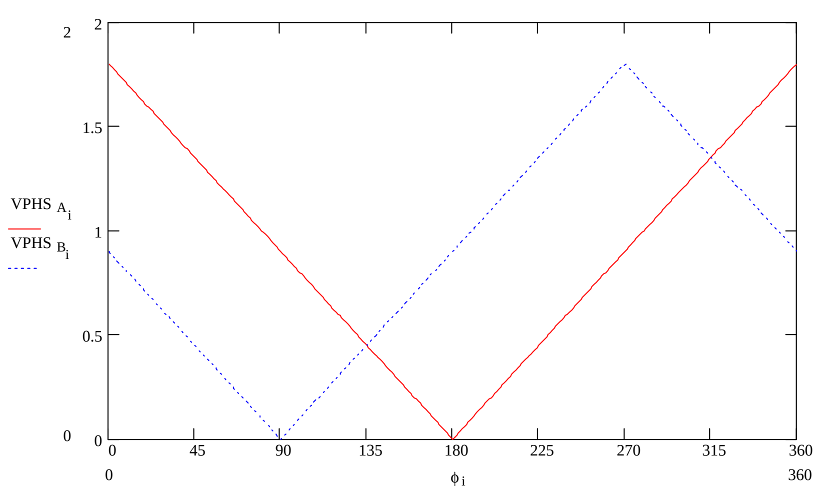
Full 360º Phase Detection with AD8302 180º Phase Detectors

1. use two AD8302's
    a. apply identical "reference signal" to each AD8302 INPB
    b. apply "unknown signal" to INPA of one of the AD8302's
    c. apply 90º-shifted "unknown signal" to INPA of other AD8302



2. Resulting VPHS outputs are shown below



3. Determine phase angle, Θ, through following decision tree:

    a. If $VPHS_A \geq (0.75*VREF)$ and $(VPHS_B \leq VREF/2)$ then $\Theta = ((VPHS_B - 0.9)/-10^{-2})$

    b. If $VPHS_B < (0.25*VREF)$ then $\Theta = ((VPHS_A - 0.9)/-10^{-2})+90$

    c. If $VPHS_A \leq (0.25*VREF)$ then $\Theta = ((VPHS_B - 0.9)/10^{-2})+180$

    d. If $VPHS_B > (0.75*VREF)$ then $\Theta = ((VPHS_A - 0.9)/10^{-2})+270$

    e. If $VPHS_A \geq (0.75*VREF)$ and $(VPHS_B \geq VREF/2)$ then $\Theta = ((VPHS_B - 0.9)/-10^{-2})+360$

(Note that there are "greater than" (>), "greater than or equal to" (≥), "less than" (<) and "less than or equal to" (≤) inequalities in the decision tree above).

This algorithm could be implemented by digitizing $VPHS_A$ and $VPHS_B$ and using an IF–THEN-ELSE or similar structure in software, then either use this digital value directly or use this digital value to produce an analog output with a DAC.

This algorithm uses only the "sweet spot" regions of each VPHS output, i.e., those portions of the curves that are centered around 900 mV.

4. Analog output voltage could be constructed from $VPHS_A$ and $VPHS_B$ according to following decision tree:

    a. If $\Theta \leq 45°$ then $V_{OUT} = VPHS_B + 2.7$ V

    b. If $(\Theta > 45°)$ and $(\Theta \leq 135°)$ then $V_{OUT} = VPHS_A + 1.8$ V

    c. If $(\Theta > 135°)$ and $(\Theta \leq 225°)$ then $V_{OUT} = 2.7V - VPHS_B$

    d. If $(\Theta > 225°)$ and $(\Theta \leq 315°)$ then $V_{OUT} = 1.8\text{ V} - VPHS_A$

    e. If $\Theta > 315°$ then $V_{OUT} = VPHS_B - 0.9V$

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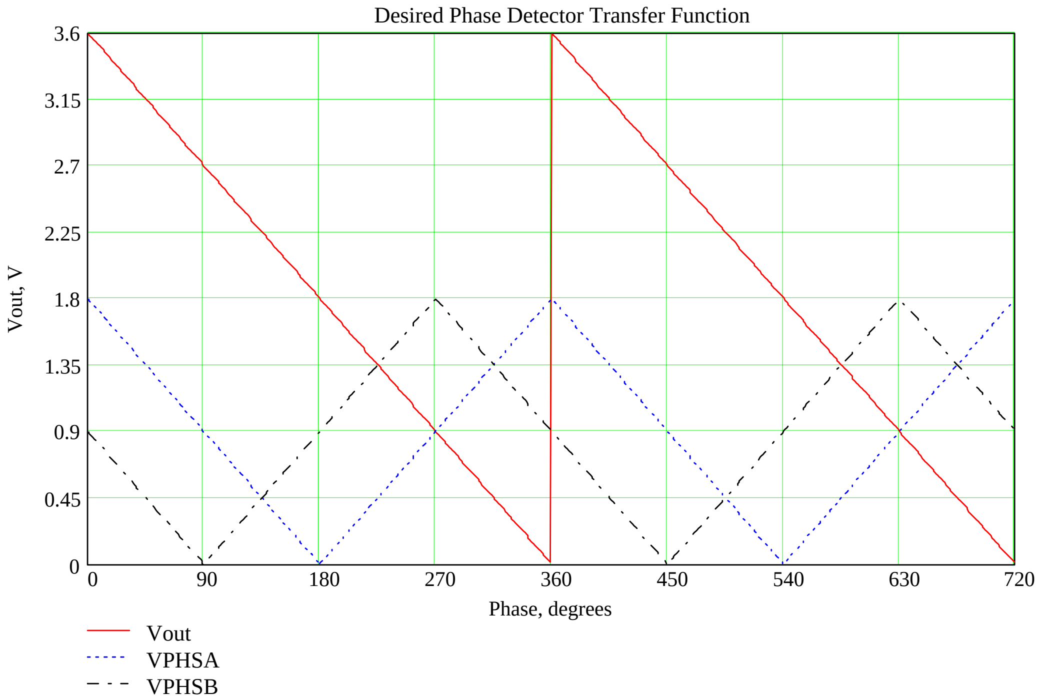
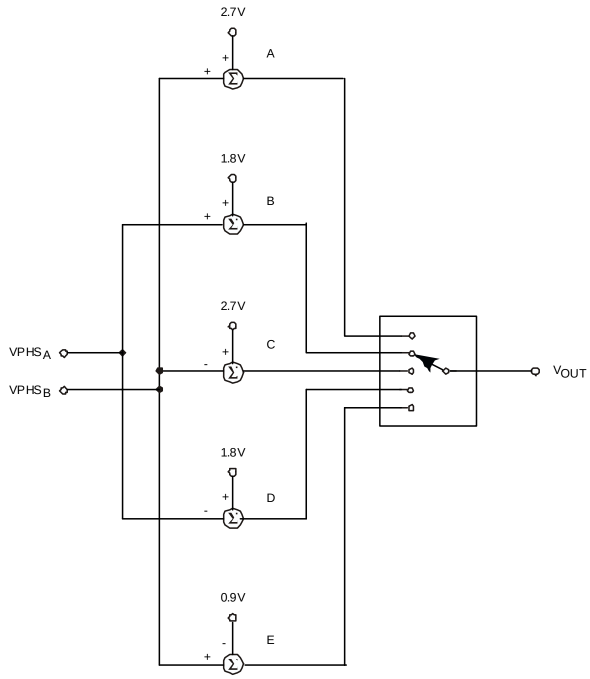


This waveform could be constructed using the VREF output to produce the constants (3/2 VREF, VREF, ½ VREF) that are combined with the appropriate VPHS output using op amp summer and subtracter circuits as shown below



Voltage A is selected when the phase angle, Θ, is > 0° and ≤45°. Voltage B is selected when Θ is > 45° but ≤ 135°, Voltage C is selected for 135° < Θ ≤ 225°, Voltage D for

$225° < \Theta \leq 315°$ and Voltage E for $315° < \Theta \leq 360°$. The selection circuit, which could be a SP5T switch, 1:8 multiplexer, etc., would be controlled by comparators which would determine the proper output voltage selection by comparing $VPHS_A$ and/or $VPHS_B$ to 0.75 * VREF, 0.25 * VREF and each other. This discrete-switching approach might be inferior to a soft-handoff approach that would gradually select transfer the input of the selection circuit.

The summing and subtracting circuits could be constructed from op amp circuits.