TMS320 DSP
Number 4
DESIGNER'S NOTEBOOK
TEXAS INSTRUMENTS

# Optimizing Control Algorithms on 'C5x

*Contributed by Alex Tessarolo*

***Design Problem***

In many control algorithms, a value resides in the 32-bit accumulator that must be either stored to a 16-bit memory location or to a peripheral device which may be less than or equal to 16 bits in resolution, i.e., 8-bit A/D converter. Prior to storage, a range check must be performed on the sign bit (S) and the guard bits (G) in the accumulator. For positive numbers within range of the desired value, S = G = 0 and for negative numbers, S = G = 1. If this is not the case, then overflow has occurred and the value stored must be saturated.

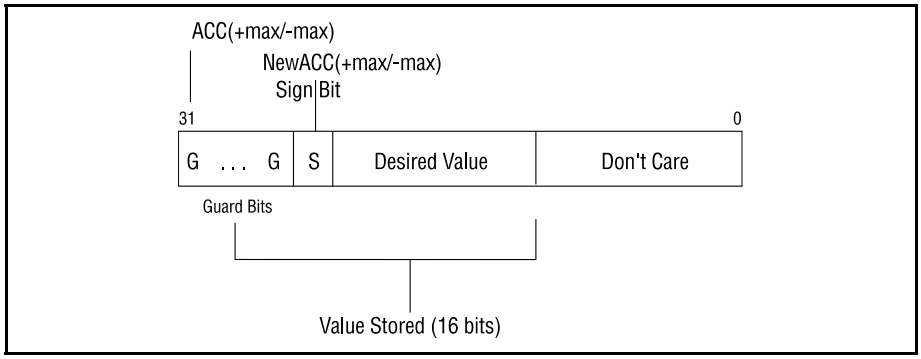


*Figure 1.*

Standard published code to perform this saturation can take up to 15 cycles. How do you minimize this overhead.

***Solution***

A technique for doing this operation which requires a minimum number of cycles is described below:

1. Calculate the difference (Diff) between the ACC positive maximum value [ACC(+max)] and the desired positive maximum value [NewACC(+max)]:

   Diff = ACC(+max) – NewACC(+max)

2. Make sure saturation mode is on (SOVM).

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TMS320 HOTLINE (713) 274-2320 TMS320 FAX (713) 274-2324 TMS320 BBS (713) 274-2323 email=4389750@mcimail.com

3. Execute the following instructions:

```
ADDH  Diff    ;Step 1
SUBH  Diff    ;Step 2
SUBH  Diff    ;Step 3
ADDH  Diff    ;Step 4,  Value to be stored is either
                        saturated or unchanged if
                        within range
```

The above operation is shown next.

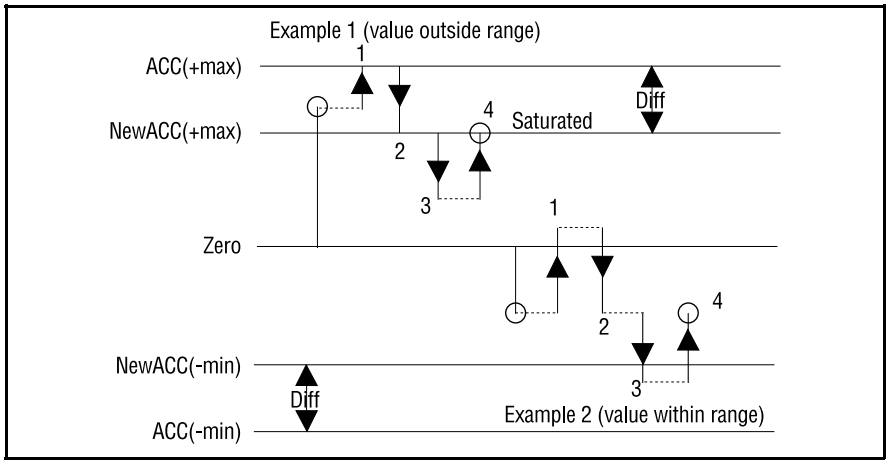


*Figure 2.*