

Utility Functions

```
vector(min,max,inc) :=  $\left\{ \begin{array}{l} \zeta \leftarrow \text{min} \\ i \leftarrow 0 \\ \text{while } 1 \\ \quad x_i \leftarrow \zeta \\ \quad \zeta \leftarrow \zeta + \text{inc} \\ \quad \text{break if } \zeta > \text{max} + 10^{-9} \\ \quad i \leftarrow i + 1 \\ \quad \text{trace("check \{0\} \{1\}", i, \zeta) \end{array} \right.$ 
x

CurveFit(x,X,Y) := interp(pspline(X,Y),X,Y,x)
```

Grab Sandia Data

Dcv :=

	0	1
0	$3.215 \cdot 10^{-4}$	11.695
1	$6.286 \cdot 10^{-4}$...

Dsg :=

	0	1
0	$5.922 \cdot 10^{-4}$	1.119
1	$7.765 \cdot 10^{-4}$...

$\text{SOC}_{cv} := \text{Dcv}^{(0)}$ $cv := \text{Dcv}^{(1)} \cdot V$ $\text{SOC}_{sg} := \text{Dsg}^{(0)}$ $sg := \text{Dsg}^{(1)}$

Plot Sandia Data

Here is a plot of my digitized plot data.

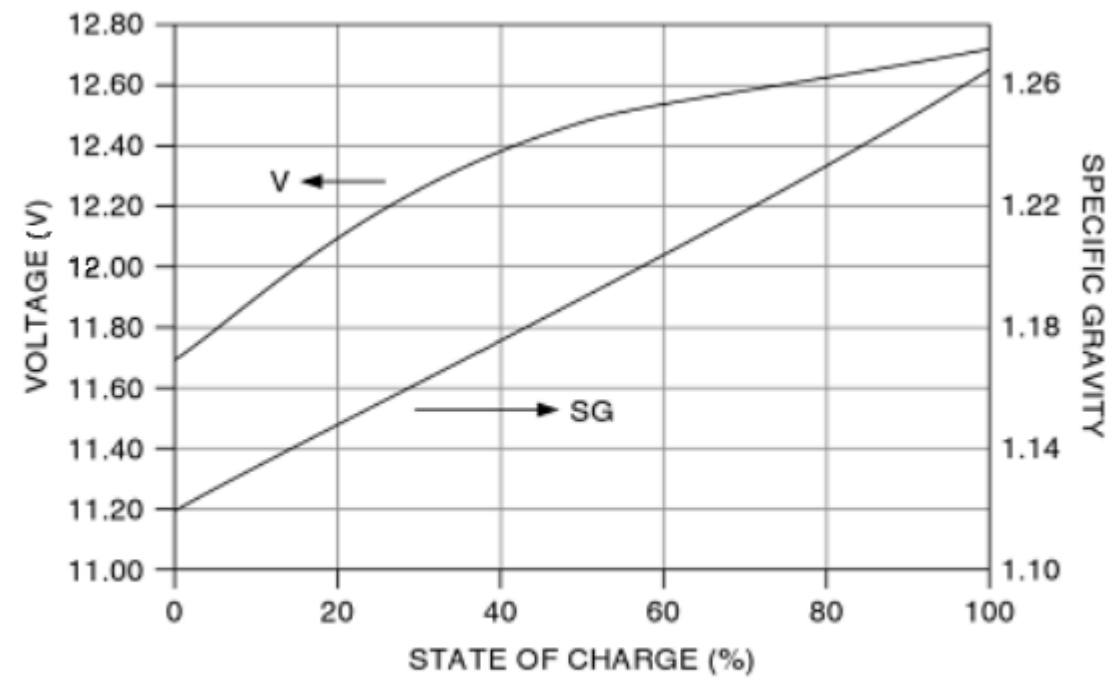
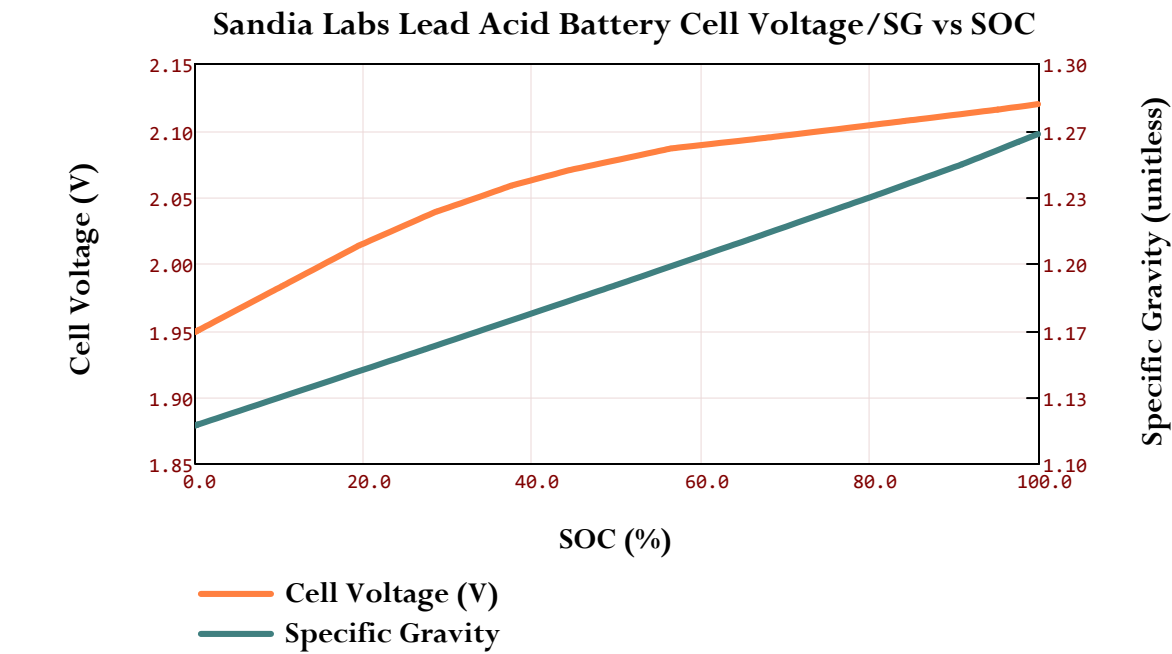


Figure 9.41 Voltage and specific gravity for a typical deep-cycle lead-acid 12-V battery. Data from Sandia National Laboratories (1991).

Parameterize Sandia Data With Respect to SG

$$cv(x) := \text{CurveFit}\left(x, \text{SOC}_{cv}, \frac{cv}{V}\right) \cdot V$$
$$sg(x) := \text{CurveFit}(x, \text{SOC}_{sg}, sg)$$
$$X := \text{vector}(0, 1, 0.01)$$

Interpolation of the cell voltage data

Interpolation of the specific gravity data

State of Charge to Evaluate

