Problem with MATPOWER:

When buses 18 and 33 are considered as PV buses (in ‘case33_gen3_PV’) with setting Qmin and Qmax , using runpf(‘case33_gen3_PV’) command leads to unacceptable results because the voltage of these two buses reached the set value, violating the Qmax limits of DGs.

In ‘case33_gen3_PV.m’ file:

```
39      17  1  60  20  0  0  1  1  0  12.66  1  1.1 0.9;
40      18  2  90  40  0  0  1  1  0  12.66  1  1.1 0.9;
41      19  1  90  40  0  0  1  1  0  12.66  1  1.1 0.9;
```

…

```
54      32  1  210 100 0  0  1  1  0  12.66  1  1.1 0.9;
55      33  2  60  40  0  0  1  1  0  12.66  1  1.1 0.9;
56    ];
57
58    %% generator data
59    %  bus Pg  Qg  Qmax  Qmin  Vg  mBase  status Pmax  Pmin  Pc1 Pc2 Qc1min Qc1max Qc2
60 -  mpc.gen = [
61      1  0  0  10  -10 1  100 1  10 0  0  0  0  0  0  0  0  0  0  0  0
62     33 0.2 0.100  0.100 -0.075 1 100 1  10 0  0  0  0  0  0  0  0  0  0  0  0
63      18  0.250 0.150  0.150 -0.080 1  100 1  10   0 0  0  0  0  0  0  0  0  0  0  0
64    ];
```

Results of runpf():

>> runpf(case33_gen3_PV)

MATPOWER Version 7.1, 08-Oct-2020 -- AC Power Flow (Newton)

Newton's method power flow (power balance, polar) converged in 4 iterations.

Converged in 0.03 seconds

```
================================================================================
|    System Summary                                                            |
================================================================================
How many?                How much?              P (MW)            Q (MVAr)
---------------------    -------------------  -------------  -----------------
Buses            33     Total Gen Capacity      30.0         -10.2 to 10.3
Generators        3     On-line Capacity        30.0         -10.2 to 10.3
Committed Gens    3     Generation (actual)      3.8               2.4
Loads            32     Load                     3.7               2.3
  Fixed          32       Fixed                  3.7               2.3
  Dispatchable    0       Dispatchable          -0.0 of -0.0      -0.0
Shunts            0     Shunt (inj)             -0.0               0.0
Branches         37     Losses (I^2 * Z)         0.17              0.14
Transformers      0     Branch Charging (inj)     -                 0.0
Inter-ties        0     Total Inter-tie Flow     0.0               0.0
Areas             1

                        Minimum                      Maximum
                -------------------------  -------------------------------
Voltage Magnitude   0.976 p.u. @ bus 25          1.000 p.u. @ bus 1
Voltage Angle      -4.41 deg   @ bus 18          0.00 deg   @ bus 1
P Losses (I^2*R)             -                  0.03 MW    @ line 2-3
Q Losses (I^2*X)             -                  0.02 MVAr  @ line 5-6

================================================================================
|    Bus Data                                                                  |
================================================================================
```

Bus #	Voltage Mag(pu)	Voltage Ang(deg)	Generation P (MW)	Generation Q (MVAr)	Load P (MW)	Load Q (MVAr)
1	1.000	0.000*	3.38	-0.31	-	-
2	0.998	-0.067	-	-	0.10	0.06
…						
17	0.996	-4.232	-	-	0.06	0.02
18	1.000	-4.412	0.25	0.85	0.09	0.04
…						
32	0.994	-4.112	-	-	0.21	0.10
33	1.000	-4.308	0.20	1.86	0.06	0.04
			---	---	---	---
		Total:	3.83	2.40	3.66	2.26

Finally, I used MATPOWER options to enforce the reactive power limits:

```
>> mpopt = mpoption;
>> mpopt = mpoption(mpopt, 'pf.enforce_q_lims', 1, 'out.all', 1);
>> results = runpf('case33_gen3_PV', mpopt)
```

```
MATPOWER Version 7.1, 08-Oct-2020 -- AC Power Flow (Newton)
Newton's method power flow (power balance, polar) converged in 4 iterations.
Gen 2 at upper Q limit, converting to PQ bus
Gen 3 at upper Q limit, converting to PQ bus
Newton's method power flow (power balance, polar) converged in 4 iterations.
Converged in 0.10 seconds
================================================================================
|     System Summary                                                          |
================================================================================
How many?                How much?              P (MW)            Q (MVAr)
---------------------    --------------------  -------------  -----------------
Buses               33     Total Gen Capacity      30.0         -10.2 to 10.3
Generators           3     On-line Capacity        30.0         -10.2 to 10.3
Committed Gens       3     Generation (actual)      3.8               2.3
Loads               32     Load                     3.7               2.3
  Fixed             32       Fixed                  3.7               2.3
  Dispatchable       0       Dispatchable        -0.0 of -0.0       -0.0
Shunts               0     Shunt (inj)             -0.0               0.0
Branches            37     Losses (I^2 * Z)         0.13              0.09
Transformers         0     Branch Charging (inj)     -                0.0
Inter-ties           0     Total Inter-tie Flow     0.0               0.0
Areas                1
                       Minimum                      Maximum
              -------------------------  --------------------------------
Voltage Magnitude   0.935 p.u. @ bus 32          1.000 p.u. @ bus 1
Voltage Angle      -0.23 deg   @ bus 16          0.57 deg   @ bus 30
P Losses (I^2*R)             -                  0.04 MW    @ line 2-3
Q Losses (I^2*X)             -                  0.02 MVAr  @ line 5-6
================================================================================
|     Generator Data                                                           |
================================================================================
 Gen   Bus  Status     Pg       Qg
  #    #             (MW)     (MVAr)
----  -----  ------  --------  --------
  1     1      1      3.34      2.10
  2    33      1      0.20      0.10
  3    18      1      0.25      0.15
                    --------  --------
            Total:    3.79      2.35
================================================================================
|     Bus Data                                                                 |
================================================================================
 Bus      Voltage          Generation             Load
  #   Mag(pu)  Ang(deg)   P (MW)   Q (MVAr)   P (MW)   Q (MVAr)
-----  -------  --------  --------  --------  --------  --------
    1   1.000    0.000*     3.34      2.10       -         -
    2   0.997    0.013       -         -        0.10      0.06
   ...
   17   0.945   -0.208       -         -        0.06      0.02
   18   0.946   -0.203      0.25      0.15      0.09      0.04
   ...
   32   0.935    0.522       -         -        0.21      0.10
   33   0.935    0.544      0.20      0.10      0.06      0.04
                         --------  --------  --------  --------
               Total:      3.79      2.35      3.66      2.26
================================================================================
```