Two data files are provided:

OSresults.mat (oversteer vehicle)
USresults.mat (understeer vehicle)

Files with a .mat extension contain MATLAB formatted data. Use the ‘load’ function in Matlab to put the contents of the file into the Matlab workspace.

The files contain the data underlying Figures 3, 4, 5, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18.

Each file contains the following data (single variable unless otherwise stated) (SI units):

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad</td>
<td>state matrix of linearised vehicle at each step (eqn 28)</td>
</tr>
<tr>
<td>Bd</td>
<td>input matrix of linearised vehicle at each step (columns are effectively Bk, Hk and Fk from eqn 28)</td>
</tr>
<tr>
<td>K</td>
<td>compensatory controller gain matrix (eqn 32)</td>
</tr>
<tr>
<td>X</td>
<td>global x coordinate of centre of mass on optimal trajectory at each step (fig 3)</td>
</tr>
<tr>
<td>Y</td>
<td>global y coordinate of centre of mass on optimal trajectory at each step (fig 3)</td>
</tr>
<tr>
<td>forces</td>
<td>lateral and longitudinal forces at front and rear tyres at each step</td>
</tr>
<tr>
<td>s</td>
<td>distance along the nominal trajectory of the centre of mass at each step</td>
</tr>
<tr>
<td>stabilityderivatives</td>
<td>state vector at each step (first eight states are as eqn 18, ninth state is lateral velocity wrt to the nominal heading, as discussed in section 4 after eqn 27.)</td>
</tr>
<tr>
<td>t</td>
<td>time at each step</td>
</tr>
<tr>
<td>u</td>
<td>compensatory control input vector at each step (first two inputs as eqn 19, u(3) is lateral force at mass centre, u(4) is yaw moment at mass centre, u(5)=1 for the linearised tyre force)</td>
</tr>
<tr>
<td>var_u</td>
<td>covariance matrix of inputs at each step (eqn 40)</td>
</tr>
<tr>
<td>var_x</td>
<td>covariance matrix of states at each step (eqn 38)</td>
</tr>
<tr>
<td>x</td>
<td>state vector at each step (first eight states are as eqn 18, ninth state is lateral velocity wrt to the nominal heading, as discussed in section 4 after eqn 27.)</td>
</tr>
<tr>
<td>param.control.T0</td>
<td>discrete time step</td>
</tr>
<tr>
<td>param.control.Np</td>
<td>prediction horizon length for optimal trajectory calculation(number of steps)</td>
</tr>
<tr>
<td>param.control.q1</td>
<td>cost function weight for optimal trajectory calculation</td>
</tr>
<tr>
<td>param.control.Ri</td>
<td>cost function weight for optimal trajectory calculation</td>
</tr>
<tr>
<td>param.dist.delta</td>
<td>std dev of steering angle disturbance (eqn 29)</td>
</tr>
<tr>
<td>param.dist.F</td>
<td>std dev of lateral force disturbance (eqn 29)</td>
</tr>
<tr>
<td>param.dist.M</td>
<td>std dev of yaw moment disturbance (eqn 29)</td>
</tr>
<tr>
<td>param.lqr.Q</td>
<td>compensatory controller cost function weighting matrix</td>
</tr>
<tr>
<td>param.lqr.R</td>
<td>compensatory controller cost function weighting matrix</td>
</tr>
<tr>
<td>param.lqr.N</td>
<td>compensatory controller cost function weighting matrix</td>
</tr>
<tr>
<td>param.car.g</td>
<td>gravitational constant</td>
</tr>
<tr>
<td>param.car.rho</td>
<td>density of air</td>
</tr>
<tr>
<td>param.car.M</td>
<td>vehicle mass</td>
</tr>
<tr>
<td>param.car.Iz</td>
<td>vehicle yaw moment of inertia</td>
</tr>
<tr>
<td>param.car.If</td>
<td>front wheel moment of inertia</td>
</tr>
<tr>
<td>param.car.Ir</td>
<td>rear wheel moment of inertia</td>
</tr>
</tbody>
</table>
param.car.a  front wheel distance from centre of mass
param.car.b  rear wheel distance from centre of mass
param.car.rf  front wheel rolling radius
param.car.rr  rear wheel rolling radius
param.car.Gsw  steering gear ratio
param.car.W  half vehicle track width
param.car.bf  proportion of braking torque on front wheel
param.car.br  1-param.car.bf
param.car.ab  proportion of aero downforce on front wheel
param.car.Ax  front cross-sectional area
param.car.Cx  drag coefficient
param.car.Cz  lift coefficient
param.car.U0  initial vehicle speed

param.tyres.C  tyre model parameter
param.tyres.B  tyre model parameter
param.tyres.D  tyre model parameter
param.tyres.E  tyre model parameter
param.tyres.cl  tyre model parameter
param.tyres.c2  tyre model parameter

param.nms.zetan  neuromuscular system damping ratio
param.nms.omegan  neuromuscular system natural frequency

param.sim.roadi  parameters for the optimal trajectory calculation
param.sim.roadint  1x2  (see section 3)
param.sim.roadw
param.sim.intpos  1x2
param.sim.z
param.sim.dcom_hatbound
param.sim.utorque_hatbound
param.sim.ltorque_hatbound
param.sim.dtorque_hatbound
param.sim.dtorque_traj_hatbound
param.sim.ddcom_traj_hatbound
param.sim.sublimit
param.sim.road.xroad  15001x1  specification of road geometry
param.sim.road.yroad  15001x1
param.sim.road.sroad  15001x1
param.sim.road.angroad  15001x1
param.sim.road.xroadl  15001x1
param.sim.road.yroadl  15001x1
param.sim.road.xroadr  15001x1
param.sim.road.yroadr  15001x1
param.sim.road.roadw
param.sim.road.roadi
param.sim.road.roadint  1x2
param.sim.road.droad  15001x1
param.sim.road.dangroad  15001x1
param.sim.road.road  15001x1
param.sim.linvehicle
param.sim.findoptimal
param.sim.loopref

results.X  650x14  results of optimal trajectory calculation (section 3)
results.ddcom  650x1
results.dtorque  650x1
results.t  650x1
results.xpos  650x1
results.ypos  650x1
results.Fzf  650x1
results.kf  650x1
results.af  650x1
results.Fyf  650x1
results.Fxf  650x1
results.Fzr  650x1
results.kr  650x1
results.ar  650x1
results.Fyr  650x1
results.Fxr  650x1
results.A  14x14x650
results.B 14x2x650
results.F 14x1x650