TRUNK KINEMATICS USING MUSCULOSKELETAL MODELING DURING RANGE OF MOTION TASKS

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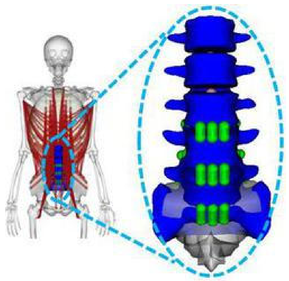
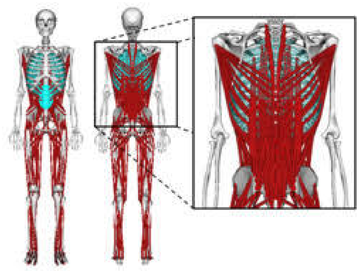
A **spine model can be used to predict post-spinal fusion motion in individuals with scoliosis**.



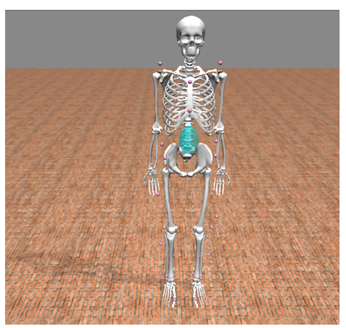
SimTK, 2011

Full-body lumbar spine model allows for modeling lumbar spine and pelvis movement and was validated for jogging.



SimTK, 2016

The full-body lumbar spine model was adapted for simulating thoracic, lumbar and pelvis motion.



The constraints between torso and lumbar spine were removed and modified to allow3 degrees of freedom for T12-L1.

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<objects />
<groups />
</ControllerSet>
<!--Constraints in the model.-->
<ConstraintSet name="constraintset">
    <CoordinateCouplerConstraint name="L1_L2_IVD_bendlat_r1_con">
        <!--Flag indicating whether the constraint is enforced or not.Enforced means that the constraint is active in
        <isEnforced>true</isEnforced>
        <!--Constraint function of generalized coordinates (to be specified) used to evaluate the constraint errors a
        <coupled_coordinates_function>
            <PiecewiseLinearFunction name="f11">
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                <y> -0.191443 0.191443</y>
            </PiecewiseLinearFunction>
        </coupled_coordinates_function>
        <!--List of names of the right hand side (independent) coordinates. Note the constraint function above, must
        <independent_coordinate_names>lat_bending</independent_coordinate_names>
        <!--Name of the left-hand side (dependent) coordinate of the constraint coupling function.-->
        <dependent_coordinate_name>L1_L2_IVD_bendlat_r1</dependent_coordinate_name>
        <!--Scale factor for the coupling function.-->
        <scale_factor>1</scale_factor>
    </CoordinateCouplerConstraint>
    <CoordinateCouplerConstraint name="patellofemoral_knee_angle_r_con">
        <!--Flag indicating whether the constraint is enforced or not.Enforced means that the constraint is active in
        <isEnforced>true</isEnforced>
        <!--Constraint function of generalized coordinates (to be specified) used to evaluate the constraint errors a
        <coupled_coordinates_function>
            <LinearFunction>
                <coefficients> -1 0</coefficients>
            </LinearFunction>
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        <independent_coordinate_names>knee_angle_r</independent_coordinate_names>
        <!--Name of the left-hand side (dependent) coordinate of the constraint coupling function.-->
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        <!--Flag indicating whether the constraint is enforced or not.Enforced means that the constraint is active in
        <isEnforced>true</isEnforced>
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        <coupled_coordinates_function>
            <LinearFunction>
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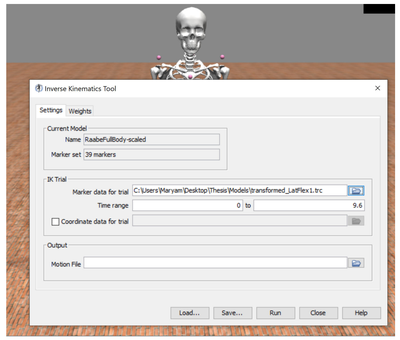
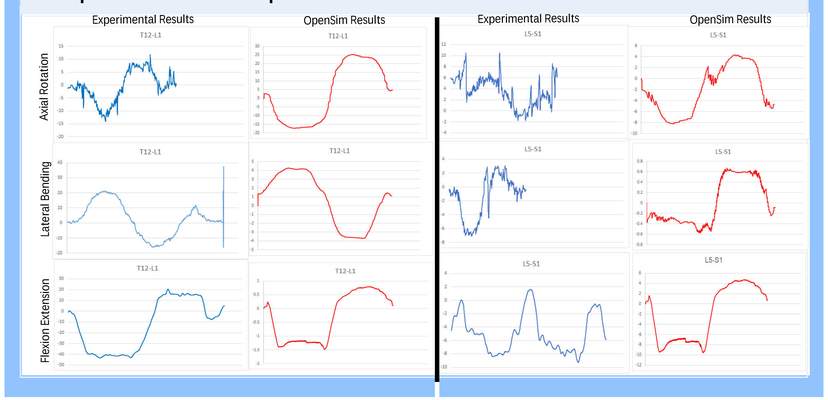
            </LinearFunction>
        </coupled_coordinates_function>
```

Inverse kinematics (IK) were calculated for the adjusted model.



The obtained range of motion at T12-L1 and L5-S1 jointswere compared to the experimental data.

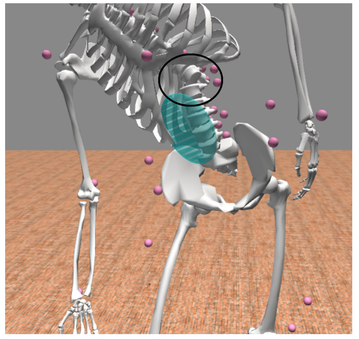


Experimental data was significantly greater than IK for sagittal and frontal planes and matched best for transverse plane for both joints.

Experimental results T12-L1:
64.4±3.8° of flexion-extension
40.8°±4° of lateral bending
29.7°±3.6° of axial rotation

Experimental results L5-S1:
30.0±7.2° offlexion-extension
10.9°±4.7° of lateral bending
13.9°±1.1° of axial rotation

T12-L1 joint motion did not corroborate in sagittal and frontal planes.



The model can be adapted in transverse plane motion to model trunk motions greater than those expected in jogging.

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