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CONTEXT
   Car_C1
EXTENDS
   ControlledSystemCtx
CONSTANTS
   stabilizing
   accelerating
   braking
   nearing_stop
   stopped
   A
   b
   v0
   SP
   f2_speed
   f1_deceleration
   f1_stable
   f1_acceleration
   f_deceleration
   f_stable
   f_acceleration
   eod
AXIOMS
   axm1: partition(STATES, {stabilizing}, {accelerating}, {braking}, {nearing_stop}, {stopped})
   axm2: A ∈ RReal
   axm3: Rzero ↦ A ∈ lt
   axm4: b ∈ RReal
   axm5: Rzero ↦ b ∈ lt
   axm51: b ≠ Rzero
   axm6: v0 ∈ RReal
   axm7: Rzero ↦ v0 ∈ lt
   axm8: SP ∈ RReal
   axm9: Rzero ↦ SP ∈ lt
   axm154: f2_speed ∈ (RRealPlus × S) → RReal
   axm155: f2_speed = (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S | v_)
   axm156: f1_deceleration ∈ ((RRealPlus × RRealPlus) → (RRealPlus × S → RReal))
   axm11:
      ∀t_init, v_init · t_init ∈ RRealPlus ∧ v_init ∈ RRealPlus ⇒ (
         f1_deceleration(t_init ↦ v_init) =
            (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S ∧ (t_ ↦ plus(divide(v_init ↦ b) ↦ t_init) ∈ lt) | uminus(b))∪
            (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S ∧ (t_ ↦ plus(divide(v_init ↦ b) ↦ t_init) ∈ geq) | Rzero)
      )
   axm10: f_deceleration ∈ ((RRealPlus × RRealPlus) → (RRealPlus × S → S))
   axm102:
         ∀t_init, v_init · t_init ∈ RRealPlus ∧ v_init ∈ RRealPlus ⇒ (f1_deceleration(t_init ↦ v_init) ∈ RRealPlus × S → RReal)
   axm101:
      ∀t_init, v_init · t_init ∈ RRealPlus ∧ v_init ∈ RRealPlus ⇒
         f_deceleration(t_init ↦ v_init) = bind(f1_deceleration(t_init ↦ v_init), f2_speed)
   axm12: f1_stable ∈ (RRealPlus × S → RReal)
   axm13: f1_stable = (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S | Rzero)
   axm130: f_stable ∈ (RRealPlus × S → S)
   axm131: f_stable = bind(f1_stable, f2_speed)
   axm132: f_stable ∈ C0(RRealPlus × S, S)
   axm14: f1_acceleration ∈ (RRealPlus × S → RReal)
   axm15: f1_acceleration = (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S | A)
   axm150: f_acceleration ∈ (RRealPlus × S → S)
   axm151: f_acceleration = bind(f1_acceleration, f2_speed)
   axm152: f_acceleration ∈ C0(RRealPlus × S, S)
   axm16: ∀t0 · t0 ∈ RRealPlus ⇒ lipschitzContinuous(S, S, partial2(f_stable, t0))
   axm17: ∀t0 · t0 ∈ RRealPlus ⇒ lipschitzContinuous(S, S, partial2(f_acceleration, t0))
   axm22: eod ∈ (RRealPlus × RRealPlus → RRealPlus)
   axm21: eod = (λti ↦ vi · ti ∈ RRealPlus ∧ vi ∈ RRealPlus | plus(divide(vi ↦ b) ↦ ti))
   axm20:
      ∀eta1, eta2, t_init, v_init, x_init·
            t_init ∈ RRealPlus ∧ v_init ∈ RRealPlus ∧ x_init ∈ RReal∧
         eta1 ∈ Closed2Closed(t_init, eod(t_init ↦ v_init)) → S∧
         solutionOf(
            Closed2Closed(t_init, eod(t_init ↦ v_init)), eta1,
            ode(
               (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S ∧ (t_ ↦ eod(t_init ↦ v_init) ∈ lt) | (uminus(b) ↦ v_)),
               (v_init ↦ x_init),
               t_init
            )
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            )∧
            eta2 ∈ Closed2Infinity(eod(t_init ↦ v_init)) → S∧
            solutionOf(
                Closed2Infinity(eod(t_init ↦ v_init)), eta2,
                ode(
                    (λt_ ↦ (v_ ↦ x_) · t_ ∈ RRealPlus ∧ (v_ ↦ x_) ∈ S ∧ (t_ ↦ eod(t_init ↦ v_init) ∈ geq) | (Rzero ↦ v_)),
                    eta1(eod(t_init ↦ v_init)),
                    eod(t_init ↦ v_init)
                )
            ) ⇒
                solutionOf(
                    Closed2Infinity(t_init), eta1 ∪ eta2,
                                ode(
                            f_deceleration(t_init ↦ v_init),
                            (v_init ↦ x_init),
                            t_init
                        )
                        )
    axm153 :
        ∀t_init, v_init, x_init·
            t_init ∈ RRealPlus ∧ v_init ∈ RRealPlus ∧ x_init ∈ RReal ⇒
                Solvable(
                    Closed2Infinity(t_init),
                    ode(
                        f_deceleration(t_init ↦ v_init),
                        (v_init ↦ x_init),
                        t_init
                    )
                )
END
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